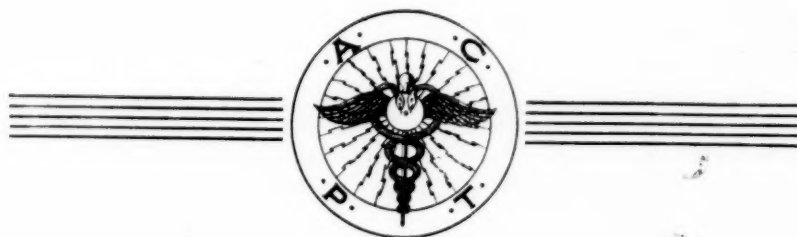


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September 6, 7, 8, 9, 1944

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Volume XXV

JUNE, 1944

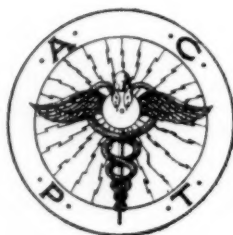
No. 6

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No. 6

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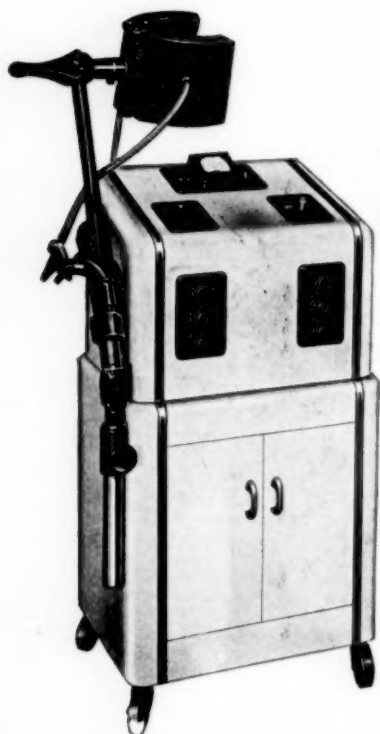
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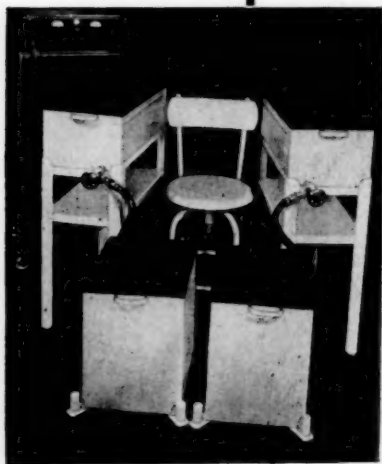
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## MEDICOLEGAL ASPECTS OF PHYSICAL MEDICINE \*

CAPTAIN H. H. BUCKELEW

Medical Corps, Army of the United States

Malpractice may be likened to a disease in that it is endemic if not epidemic in distribution, and its incidence is increasing to such extent that it warrants consideration. It may be regarded as a contagious disease, in that the winning of an action almost invariably causes an increase in the number of claims in the locality. The predisposing factors are ethical instability or deficiency, carelessness and lack of forethought and tact. Symptoms of this disease are (1) tactless or careless medical personnel and (2) a disgruntled or dissatisfied patient with or without a just cause for complaint. The onset and course of this disease are legal matters and have a place beyond the scope of this discussion. The treatment, however, is another matter, and it is to this phase that discussion will be directed.

Treatment may be considered from the standpoints of (1) prevention and (2) specific management. Writing on this subject Regan stated: "Prevention is the best defense against malpractice, and making our ethics practical is the most important factor. The doctor must care for every patient with meticulous attention to the requirements of good practice and he must keep himself in position to prove that the standard demanded by law has been met in every case."<sup>1</sup>

It is true that prevention is most important from every standpoint, for whenever a physician is brought to trial he is certain to lose, even if he wins the legal aspect. It is doubtful that the publicity attendant on litigation has ever been beneficial to the physician regardless of the outcome of the case.

The following preventative measures are axiomatic in the realm of medicine, whether physical medicine or any other branch:

### I. *Physical equipment:*

- A. Office impedimenta should be arranged to prevent accidents by stumbling or falling.
- B. Radiators and other heating devices should be covered.
- C. Exposed wiring in connection with electrical devices should be guarded.
- D. Stairs, steps and other hazardous objects should have guard rails.
- E. Adequate hoists and steps should be provided to prevent falls when the patient is getting into or onto treatment devices.
- F. Lighting should be adequate.
- G. Periodic inspection to see that all physical equipment is kept in good order and repair is necessary.

### II. *Records:*

- A. Complete and accurate records of the history, examination, diagnosis, treatment, progress and disposition of every case should be kept.
- B. Records of consultations and advice to individual patients should be kept.
- C. These records should be accurate as to dates, time and places.

### III. *Personnel:*

- A. Employees should be tactful and schooled in the wisdom of silence on matters which might create an unfavorable impression.
- B. Employees should be properly trained in the application of treatment devices.
- C. Employees must learn to investigate all complaints and have the judgment to call the responsible physician when there is question.
- D. Employees should assist the patient in all movements and remain within earshot while the patient is under treatment.

### IV. *Management:*

\* This work was done by Captain Bucklew while he was a student officer, under the direction of Dr. Frank H. Krusen, on temporary assignment in physical medicine at the Mayo Foundation, Rochester, Minn.

A. Meticulous attention to the requirements of good practice must be given in each case.

B. Experimentation with hazardous equipment should be avoided.

C. The physician should be specific in prescribing treatment to be given by an employee, but should train the employee to use good judgment in carrying out orders.

D. The laboratory should be used when indicated.

E. Care should be used in accepting the judgment of others. It is surprising how often physicians confuse ultraviolet and infra-red ray therapy.

V. *Tact*:

A. It should be recognized that the sensibilities of an ill person are in a state of imbalance.

B. The physician must remember that the patient is in better position to know what he feels, smells, tastes and so forth than the physician can ever be.

C. A little psychotherapy goes well with any other treatment.

D. "See no evil, hear no evil and speak no evil" should be followed when other members of the medical profession are concerned.

E. It is not enough that the physician is right. He must convince the patient that he is right.

Many other points might be mentioned for the sake of completeness, but a review of malpractice cases over the past twenty years indicates that application of the principles mentioned would have forestalled most of them. It is not at all difficult to find practical examples in abstracts of medicolegal cases to demonstrate the wisdom of these principles.

#### Illustrative Cases

I shall mention three cases in which physical equipment was involved:

In the case of *Hoover vs. Goss* (Washington)<sup>2</sup> the defendant physician had finished a local treatment and the patient was told to remain on the treatment table until she felt all right. She got up immediately after the physician left the room, fainted, fell on a radiator and was burned. The case was dismissed only after much litigation. In the case of *Saltzer vs. Reckard* (Pennsylvania)<sup>3</sup> the plaintiff, after recovering from an illness, was visiting in the physician's office. While there he complained of feeling faint. The physician assisted him to a stool and told him to lower his head. He fell, upsetting a sterilizer of boiling water and received a severe burn. The jury awarded the plaintiff \$5,000. The supreme court finally reversed the decision. A third case involved a roentgenologist who had not kept his equipment in good repair. A bracket came loose while a roentgenogram was being taken, a portion of the apparatus fell and the patient's nose was broken. The jury held for the plaintiff.

The case of *Cappell vs. Jones* (New Jersey)<sup>4</sup> illustrates the necessity of the attendant's remaining within earshot. During the application of heating pads to the calf of the patient's leg, the nurse employee left the room for twenty minutes. The patient was burned. The courts finally held for the plaintiff.

The defendant physician does not profit if his employees remain within earshot of the patient unless complaints are investigated. In the case of *Sima vs. Wright* (Michigan)<sup>5</sup> the plaintiff sued the physician for burns alleged to have been caused by a diathermy treatment. In his complaint, the plaintiff stated that two minutes after the plates had been applied to his back, he complained of heat to the nurse employee. She made no investigation. A few minutes later, he complained again, only to be ignored. When the physician finally removed the plates, the plaintiff testified that he could smell burned tissue. The jury held for the plaintiff.

The case of *Grubbs vs. McShane* (Florida)<sup>6</sup> illustrates the value of care and tact in giving instructions for the home treatment of patients. The patient had had an abdominal operation, and phlebitis had developed after

she had gone home. The physician had instructed a lay member of the family in the manner of building and the use of a heat cradle made of barrel staves and electrical fixtures. The patient received blisters and complained to the physician, who insisted that the cradle be left intact and that the number of light bulbs be decreased. A suit developed later. The case was defeated only after expert testimony had shown that the blisters might have been caused by the phlebitis.

That care should be used in accepting the judgment of others is demonstrated in the case of *Krumeich vs. Sundelson* (New York).<sup>7</sup> The patient presented the physical therapy physician with a prescription for ultraviolet light, reading seven minutes at 27 inches (68.5 cm.). The defendant applied the light seven minutes at 6 inches (15 cm.). The jury presented the plaintiff with a favorable decision.

There is no excuse for the physician to fail to use good clinical judgment. In the case of *McCullough vs. Langer* (California)<sup>8</sup> a crushing, bruising injury to the flesh of the left thigh was treated by packs after an opiate had been administered. Towels wrung out of saline solution and covered by a rubber sheet and a dry towel were applied and kept hot by a 500 watt infra-red lamp at 21 inches (53 cm.) for four hours. The patient went to sleep, and when the pack was removed a third degree burn was present which subsequently removed \$25,000 from the doctor.

The need for attention to minor details is dramatized by a case<sup>9</sup> in which a patient was receiving diathermy for a bruise on the cheek. She was wisely advised to report if she felt a burning sensation. She testified at the suit that she reported a "tingling" sensation several times to the physician, who probably forgot that devitalized tissue and some anesthesia were present. The failure to investigate, and the fact that a burn was sustained from the machine, which experts said was capable of causing a burn and capable of being controlled, lost the suit for the physician.

In a review of the foregoing cases, it is impossible to gather all of the factors that enter into a malpractice suit. The elements of personalities, careless words and tactless acts are all submerged between the lines of legal phraseology. Nor is it possible ever to read that the harassed doctor was tired, overworked and mentally exhausted. Suffice it to say that in any case an ounce of prevention would have been worth a pound of cure.

### Defense Against Malpractice Suits

Defense might be considered the specific treatment against the malpractice "disease." In legal language, a defense is a full answer to the whole or to some part of the plaintiff's demand. In the language of the physician, it is that which is offered to show why the plaintiff should not establish what he seeks. It is intended to defeat the action.

When a physician is confronted with a suit, his wisest action, in most cases, is to settle the matter out of court if this case can be done without too great sacrifice. Assuming that in a given case the physician determines to let the matter go to trial, that is, to let the matter be settled by "twelve men, good and true," either he can acknowledge the allegations in the complaint or he can deny them and assert that the plaintiff has no grounds for action. I shall make no comment on the first method. If the physician denies the allegations of the plaintiff, the burden of proof will then lie on the plaintiff to show lack of skill or want of care. Furthermore, in many cases the plaintiff will be required to show by expert witness wherein the doctor failed to exercise ordinary skill and care common to the locality. The evidence of expert witnesses is often dispensed with in the realm of physical

medicine, because courts have held repeatedly that any witness can testify to that which he sees and knows. So often in physical medicine the act or instrument or its use speaks for itself (*res ipsa loquitur*). Nearly all of the implements of the physical therapy physician are capable of producing injury. All of these implements are capable of being controlled to prevent injury. Therefore, if injury results from their use, it may be inferred that ordinary skill and care were not used in their application.

What then is the physician's line of defense? Discussion of such technical defenses as jurisdiction, abatement, *res judicata* and statute of limitations have no place here. They are the armamentarium of the attorney, which the physician must surely employ. There are three elements of the defense that are the responsibility of the defendant physician. These are as follows: (1) complete and accurate records referable to the case—these should be honest records without the taint of "doctoring"; (2) the names of eye-witnesses who will testify in the case, and (3) the names of consultants or other members of the medical profession who will testify as to the adequacy of skill and care. Beyond this the physician should be prepared to defend his judgment from every possible line of attack. His attitude should be one of calmness, humility and simplicity.

Perhaps it would be well, while I am on the matter of defense, to discuss some of the basic considerations in the matter of evidence. In reading abstracts of medicolegal cases, one frequently encounters the phrase *res ipsa loquitur*, which was referred to briefly before. In its application to physical medicine, the best definition is "the thing speaks for itself." When this rule of evidence is invoked, it creates either a presumption or an inference of negligence. The Supreme Court of the United States,<sup>10</sup> commenting on this rule many years ago stated:

When a thing which causes injury without fault of the injured person is shown to be under the exclusive control of the defendant, and the injury is such as in the ordinary course of things, does not occur if the one having control uses proper care, it affords reasonable evidence, in the absence, of explanation, that the injury arose from the defendant's want of care.

Prominence has been given this rule because of its obvious application to physical medicine. States vary in their philosophies concerning malpractice. Almost every rule and philosophy known to law applied to malpractice is found in a review of these cases. One particularly vicious doctrine is encountered often enough to cause comment here. This is known as the "loaned servant doctrine." This doctrine holds that the servant of an employer can be loaned or hired to another employer for a particular piece of work, and that the servant then becomes the employee of the borrower, who accepts the responsibility for his acts. The case of *Bishop vs. Drs. A and H of Oklahoma*<sup>11</sup> illustrates the application of this doctrine. While Bishop was undergoing surgical intervention by Drs. A and H, a pan of hot water was placed between his feet by a nurse who was regularly employed by the hospital but was assisting in the operating room at the time. Thus, the court held, the nurse was temporarily "loaned" to Drs. A and H, who were responsible for her acts. By application of the "loaned servant doctrine" the physicians were held liable. Justice William H. Taft commented many years ago that few would be courageous enough to practice the healing art if this doctrine were applied often. However, it cannot be denied that its use has become more prominent in recent years.

In concluding this discussion, it is well to consider again those classic remarks of the Supreme Court of Missouri in discussing what the law demands of a physician:<sup>12</sup>

The law exacts of a physician and surgeon who undertakes to treat a patient that he (1) possesses that degree of skill and learning which is ordinarily possessed and exercised by the members of his profession in good standing, practicing in similar localities; (2) use reasonable care and diligence in the exercise of skill and the application of his learning, and (3) act according to his best judgment. Conversely he is liable for an injury to his patient resulting from want of the requisite knowledge and skill, or the omission to exercise reasonable care or the failure to use his best judgment.

And, I might add, be prepared to prove that you have met these requirements.

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## RESUSCITATION OF THE DROWNED TODAY \*

FRANK C. EVE, M.D. (CAMB.), F.R.C.P. (LONDON)

HULL, ENGLAND

*In Seven Seas the victims drown;  
Their cries for help imagination hears.*

A year ago our implicit faith in Schafer's almost sacrosanct method was shaken by Surgeon Commander Gibbens, who wrote that in the Royal Navy this method was rarely successful, although practiced by trained hands. The victim's chest felt to him "like putty," and ventilation of the lungs could not be effected. Doubtless this lack of response in bad drowning cases is due to lack of muscular tone, and this in turn is due to asphyxia of the nerve cells, situated between brain and spinal cord, which maintain tone and respiration. Now the main respiring agent is a thin sheet of muscle (the diaphragm) at the base of the lungs. In health this is pulled up into a dome by the elastic contraction of the lungs. When the diaphragm contracts, its dome is lowered and air is pulled into the chest. But when the diaphragm loses its tone progressively, as in drowning, it is pulled up by the elastic lungs into a position of extreme expiration. Schafer's method would then be useless, especially as it depends entirely on the elastic tone of muscles (no longer present) for inspiration when the pressure of the hands is taken off the patient's back. Schafer naturally assumed in 1908 that his method, which works well in normal conscious persons, would also work in the almost drowned, but this unfortunately is not true. What then are we to do about it?

In the first place we must not be hoodwinked by figures for the ventilation of the lungs derived from artificial respiration of conscious subjects. The only reliable imitations of a nearly drowned person are the newly dead cadaver and perhaps the deeply anesthetized person whose lungs have been overventilated to wash out carbon dioxide. In ventilation tests on the warm cadaver, Schafer's method yields only about 30 cc. (totally inadequate) and Silvester's method—of changing the size of the chest by extending the arms and then compressing the chest with them—yields 200 cc., which is probably just adequate. Two normal men anesthetized and their carbon dioxide washed out gave ventilations of 660 cc. for the Schafer method and 930 cc. for the Silvester method. Hence, of these two older methods which do not require apparatus, I would certainly start off with Silvester's method in a bad or pulseless case of drowning, though Schafer's method will probably succeed in milder cases. Silvester's face-upward method has the drawback that the flaccid tongue is liable to fall back and obstruct the airway, so that a second rescuer is needed to pull forward the tongue (or lax lower jaw). Schafer's technic is free from this objection, and mucus or water drains away better from the mouth in the prone position. Schafer's method is much improved if a second operator (at the head end) lifts the extended elbows (and hence the chest) off the ground during inspiration (figs. 2 and 3). I read this Nielsen modification had been adopted by the New York Emergency Service.

### Resuscitation With Breathing Machines

I can pass over the "iron lung," which is needed only in prolonged hos-

\* Reprinted with permission, J. A. M. A. 124:964 (April 1) 1944.



pital cases of failure of respiration such as paralysis of the diaphragm by infantile paralysis or diphtheria. With the American partiality to machinery, there has been a remarkable vogue for various "suck and blow" machines for the drowned and in similar cases. In England they have not been favored. Professor Yandell Henderson strongly condemns them, but he still (in a recent letter) thinks Schafer's method adequate if aided by oxygen containing 6 to 10 per cent of carbon dioxide (seldom available for the drowned).



Fig. 1. — Rocking on a trestle. (Copyright by Surgeon Commander G. H. Gibbens, R. N. V. R., Fairlawn, Sidmouth, Devon, England.)

### The Rocking Method

In 1932 I was called to a girl, aged 2 years, propped up in bed, deathly pale and rapidly dying of the "death rattle" (mucus surging to and fro in the windpipe). I noticed that the diaphragm was not working, and inquiry elicited that the child had diphtheria six weeks previously but had been well till her breathing went wrong a few hours before my visit. In cases of "death rattle" I always tilt the patient so that the windpipe slopes down hill and the mucus drains into the throat, from which it can be swabbed. This tilt cured the death rattle in a few minutes, but I reflected that it could compress the lungs and thus conduce to pneumonia if continuous. I asked if they had a rocking chair in the house so that the head-up and head-down

posture could be alternated. Most fortunately they had a long rocking chair, to which a platform of folded blankets was added and the child tied on. Why not now alternate the tilt a dozen times a minute, so that the weight of the abdominal contents could push and pull the diaphragm up and down like a piston? This was done continuously by the devoted parents, completely relieving the child's breathing till the diaphragm paralysis passed off after two and a half days. She is still alive and healthy. In this interesting way I stumbled on a new method of resuscitation by rocking. With the expert aid of Dr. Esther M. Killick it was found (in the Leeds physiology labora-

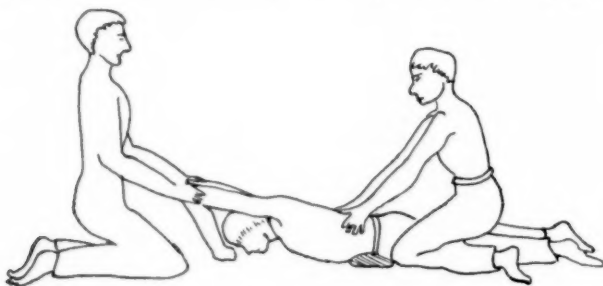


Fig. 2. — Schafer-Nielsen method of resuscitation, inspiratory phase.

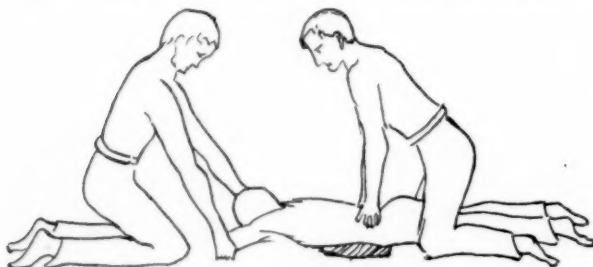


Fig. 3. — Schafer-Nielsen method, expiratory phase.

tory) to be efficient, and at ten double rocks a minute with a tilt of 50 degrees to ventilate 600 cc. per rock (normal 500 cc.). This is ample ventilation: more would introduce the possible subtle dangers of acapnia (too little carbon dioxide in the blood).

#### Rocking Method Adopted by Royal Navy

Faced by the failures of Schafer's method, Surgeon Commander Gibbens turned with relief to my rocking method, which worked by gravity and was independent of muscular tone. He adapted it to ships by fixing, under the middle of an ordinary stretcher, a pair of grooved wooden blocks to prevent slipping. On these it could be rocked 45 degrees each way, either on a trestle 34 inches high or on a loop of rope slung from the hammock hooks (fig. 1). The method has now (1943) been adopted preferentially in the navy and is fully described and illustrated in "First Aid in the Royal Navy," published at 2 shillings. Schafer's method is used promptly and till rocking can actually begin. The patient is laid face downward and the ankles and wrists are lashed to the handles of the stretcher. The first head-down tilt of 45 degrees is maintained till no more water drains from stomach or lungs. After a few minutes a tilt of 30 degrees each way (ten times a minute) will be enough to ventilate the lungs. The advantages are that untrained operators can work it instead of relays of skilled operators needed

by manual methods. It cannot injure ribs or viscera and is independent of muscular tone in blood vessels or diaphragm, in which respect unfortunately Schafer's method fails. Wet clothes can be removed during rocking and warmth applied.

In spite of many efforts I have not been able to get this method tested on the warm cadaver. But Dr. Macintosh, Nuffield professor of anesthetics at Oxford, has tried it out (1943) under deep anesthesia (in apnea) on Squadron Leader Pask, who was an anesthetist and realized that tests on conscious persons were useless. He nobly volunteered to be tested with proper recording instruments with ten double rocks per minute. The yields were Schafer 340 cc., Silvester 400 cc. and Eve 580 cc., with a tilt of 45 degrees each way. This experiment is considered to imitate the condition of a drowned man, but I doubt that tone in the diaphragm is completely lost.

#### **Resuscitation in a Boat**

If an almost drowned person is picked out of the sea into a boat he will, if nothing is done, be dead before the shore or ship is reached. Crowding or deep thwarts may prevent Schafer's method being carried out. Hence I tried lying prone on the four flexed forearms of two men standing up facing each other in a ship's lifeboat and gripping each other's hands, or, better, a rope quoit or ring bandage. My axillas and groins were thus supported while the legs, arms and head hung limply. By swaying from their hips the two men rocked my 10 stone (63.5 Kg.) a dozen times a minute through about 40 degrees each way. Ventilation seemed adequate, for I did not need to breathe. They thought they could easily keep it up for a quarter of an hour or more. My modified Silvester method seems better still (not yet published). These manual methods have not been tried out but would be a long way better than nothing. Ashore a two-wheel builder's hand cart would serve for rocking, the victim's legs being lashed to the (abbreviated) pole handle. It could also carry blankets, macintoshes and life buoy to organized bathing places.

#### **The Three Essentials of Resuscitation**

The term artificial respiration seems dangerously misleading because it focuses attention on ventilating the lungs. I submit that resuscitation is actually a trinity of ventilation, circulation and warmth directed to supplying warm blood, oxygenated by moving lungs, to the microscopic nerve cells which maintain respiration and tone. These are situated where brain and spinal cord unite and can (I found) be paralyzed by cold and quickly revived by warmth. To illustrate what happens, Dr. H. W. Haggard was at hand to do artificial respiration when a man had a sudden fatal heart attack. He found he could ventilate the lungs normally at first, but after ten to fifteen minutes this became impossible. The nerve cells which maintain tone of the diaphragm had died of asphyxia and the elasticity of the lungs had drawn up the flaccid diaphragm into full expiration. Similarly in the apparently drowned, if too long unsuccored, the nerve cells will die of asphyxia, and then all hope is gone. Till then they may be revived by artificial respiration, seldom successful after trying for an hour, though rarely up to eight hours. The heart dies more slowly than the nerve cells, for after drowning the human heart has been revived by perfusing oxygenated saline solution, a baby's heart after several hours.

#### **Restoration of Circulation'**

Probably in the future the merits of rival methods of resuscitation will

be judged more by their effects on the circulation than on ventilation, which is so much easier to produce and to measure. For air in the lungs is useless unless the oxygenated blood is conveyed to the dying nerve cells. Up till now the effects of artificial respiration on the circulation have been crudely guessed from the alterations it produces in the pressures inside the heart of the newly dead man. Silvester's method, which opens up the ribs and then presses them tightly shut again, produces a pressure change of 26 cm. (of water) inside the dead heart: the Schafer method yields only 4 cm., increased to 22 cm. by Nielsen modification. (The corresponding figures for ventilation are 280, 20 and 210 cc.) These (larger) pressure changes should help to restart the heart. It may be argued that Schafer's method should help by squeezing blood into the heart from the great veins in the abdomen. But it has been found (1939) in the Banting Institute, Toronto, that in drowned dogs (after artificial respiration and death) the venous side of the heart is overfull and the arterial side too empty. Bleeding was useless: amyl nitrite and carbon dioxide-oxygen mixture were helpful. Thus the apparent gain by the Schafer method seems likely to prove a disadvantage. The problem seems to be how to get the blood past the collapsed lungs and right side of the heart.

#### The Rocking Method and the Circulation

To clear my own ideas I have found the diagram (shown in figure 4) most helpful and instructive. Since gravity in rocking affects only the longitudinal blood vessels, they can be represented as straight tubes: the arms and head (for clarity) can be omitted as they counterpart the legs and trunk: the tangled confusion of the heart can be simplified into two rubber syringes. Observe the one-way valves in the veins and heart, and, particularly the broken line C. This indicates the coronary artery which carries oxygenated blood from the main artery through the actual muscles of the heart and so to join the blood flowing back into the lungs. If now we tilt the diagram (or the patient whose heart has stopped or nearly so) into the head-down tilt we see that the pressure of about 4 feet of blood in the arteries will slam shut the main (aortic) heart valve and have no option but to travel through the oxygen starved heart muscle. This should be invaluable in starting a stopped heart or restoring a feeble one. Similarly the nerve cells of the brain and breathing center will receive blood rhythmically at a hydrostatic pressure which I calculate will be fully normal. The veins of the extended arms will acquire a reservoir of blood ready to fill the heart again when the legs are tilted down. Every drowning person is shocked, and in shock the venous side of the heart is said to be always starved of blood. In that case the head-down tilt will fill it and encourage it to beat and pump. That is why in shock we raise the foot of the bed: an empty heart pump evidently cannot work.

Now tilt the diagram (or patient) feet down. Blood falls from the lungs past the open valves of the left side of the heart into the arteries of the trunk and legs. Hence, in rocking, gravity propels the blood alternately in arteries and veins in the direction of the arrows; reflux is prevented by valves in the veins and heart. My faith that this will happen is confirmed by Sir Leonard Hill, the English physiologist, whose experiments (he writes me) showed that blood flow to the brain can be kept going by head-up and head-down positions alternated. For this and other reasons he considers my rocking method the best way of doing artificial respiration.

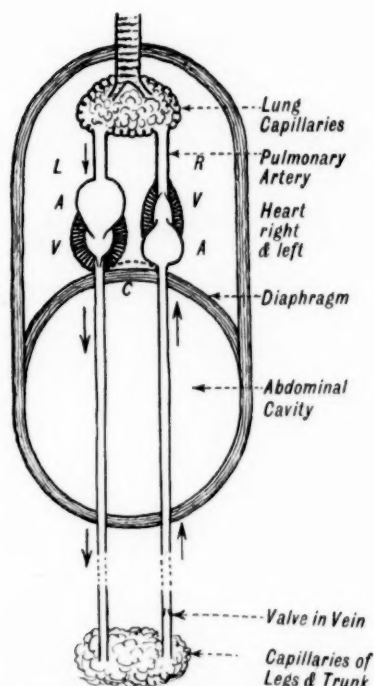


Fig. 4. —Diagrammatic representation of the circulation.

### Warmth

In victims of drowning the production of heat is minimal and the loss of heat maximal, especially from evaporation in a wind. Heat loss is visible only to the eye of the imagination and hence is often forgotten. Remembering that the revival of chilled nerve cells is our goal, I suggest hot bottles saddle bagged over the neck, or an electric cradle tied to the head end of the rocking stretcher. I read that a rigid corpse like fakir was quickly brought to life, after being for ten days actually buried alive, simply by pouring hot water abundantly, chiefly over the head, neck and heart.

This seems worth trying for the drowned, who are already wet. Carbon dioxide is greatly used in resuscitation, as (normally) it is a splendid stimulant of the respiratory nerve cells when mixed 5 per cent with oxygen and inhaled. Yet Professor Macintosh tells me that he and several American anesthetists have recently abandoned its use because it is a dangerous depressant to the nerve cells of those at the point of death.

### Conclusions

Resuscitation of the drowned is not merely working the bellows of the lungs but a fight to revive cold asphyxiated nerve cells by a circulation of warm blood oxygenated by moving lungs. Our old comfortable confidence in Schafer's method has been roughly shaken: Silvester's method is in many ways better, and the recent rocking method seems more promising still. Uncomplacently we must all "go to school" again. More experiments are badly needed: resuscitation is in the melting pot.

81 Beverley Road.



# RATIONALE FOR ELECTRODIAGNOSIS AND ELECTRICAL STIMULATION IN DENERVATED MUSCLE \*

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Much confusion exists in regard to the use of electrical stimulation in the treatment of denervated muscle. There is disagreement as to the value of such therapy,<sup>1</sup> although most of the more recent evidence is in its favor.<sup>2-3-4-5</sup> The type of stimulating current to be used in any given case is not well understood. Some time ago we initiated a broad research project with three major objects in mind: (a) to collect the available information on the electrical excitation of normal and denervated muscle and with this as a basis to construct an apparatus suitable for the experimental study of electrodiagnosis and electrotherapy; (b) to study the effect of different forms of electrical stimulation on the rate of atrophy of denervated muscles, and (c) to outline on the basis of experimental studies the requirements for an electrodiagnostic and electrotherapeutic apparatus suitable for clinical use and to establish the best methods for the application of electrotherapy. The last involves the evaluation of such variables as type of current, intensity of contraction, and length and frequency of treatment. The present communication deals with the design of our experimental apparatus and the physiologic principles on which it is based.

## Rationale of Current Design

The apparatus was designed with the following objects in mind: (a) to provide for the quantitative study of normal and denervated muscle with special reference to electrodiagnosis; (b) to provide for the production of twitch contractions, tetanic contractions or any intermediate type in muscles of widely varying excitability characteristics; (c) to provide for the selective stimulation of muscles of low excitability without effecting neighboring muscles of higher excitability. In order to understand the selection of current types for these several purposes, one should recall to mind certain basic principles of electrophysiology.

The current characteristics of fundamental importance in the stimulation of muscle are: (1) intensity, (2) duration, (3) rate of change and (4) frequency. The major differences between a muscle of high excitability (i. e., normal human skeletal muscle) and one of low excitability (denervated human muscle; muscle of snail's foot) are tabulated as follows:

	High Excitability	Low Excitability
1. Current duration.....	Short	Long
2. Minimal current gradient.....	Steep	Less steep or absent
3. Optimum frequency for sinusoidal alternating current.....	High	Low
4. Frequency for complete tetanus.....	High	Lower

\* From the Department of Physiology, Northwestern University Medical School.

\* Aided in part by a grant from the National Foundation for Infantile Paralysis, Inc.



In other words, a current will produce a response only if it lasts long enough and rises fast enough. For normal muscle, the minimal required duration is relatively short and the current must rise relatively rapidly to be effective. For denervated muscle, the minimal duration is longer, but the current may rise slowly and still be effective. These two basic factors are responsible for the differences in response to sinusoidal alternating current. The difference in tetanizing frequency is related to certain changes in the mechanical properties of denervated muscle to be mentioned later.

### Application to Study of Electrical Excitability and Electrodiagnosis

The quantitative expression of electrical excitability of nerve and muscle has been attempted by Hill,<sup>6</sup> Monnier,<sup>7</sup> Rashevsky<sup>8</sup> and others. Excitability is expressed in terms of two time constants. The evaluation of these constants involves a study of the reaction of the muscle to condenser discharges, to linear or exponentially rising currents and to sinusoidal alternating current. The first of these has long been used in the determination of chronaxie and strength-duration curves. The second, the so-called progressive currents, were studied extensively by Lucas,<sup>9</sup> by Fabre<sup>10</sup> and recently by Skoglund.<sup>11</sup> Their use for purposes of electrodiagnosis has been stressed by Neoussikine and Abramowitsch,<sup>12</sup> by Bauwens<sup>13</sup> and more recently by Pollock, Golseth, Arieff, Sherman, Schiller and Tigay.<sup>14-15</sup> The reaction to sinusoidal alternating current has not been applied to the study of denervated muscle. It has certain characteristics which make its further study desirable. Our apparatus was designed to permit a complete study of these three forms of stimulation.

### Application to Electrotherapy

*A. The Production of Tetanus.* — Smoothly graded tetanic contractions which closely simulate a voluntary effort can be produced in denervated muscle just as they can in normal muscle.<sup>2-5</sup> This we have confirmed in an investigation the results of which will be soon published. In electromuscle stimulation as it is usually practiced in the clinic, no distinction is made between the types of contraction produced by different forms of current. There are two reasons for stressing this point: (a) normal voluntary contractions are tetanic contractions and (b) the tension developed during a tetanus is greater than that developed during a simple twitch. In regard to the latter point, evidence indicates that vigorous exercise is essential to the production of beneficial results from the electrical stimulation of muscle.<sup>1-4-5</sup> We therefore regarded it desirable to produce the type of contraction which is most physiologic and at the same time permits a greater development of tension.

*B. Mechanical Properties of Denervated Muscle in Relation to Tetanus.* — It is generally taught that in contrast to the brisk twitch response of normal skeletal muscle, denervated muscle responds to stimulation with a slow, prolonged contraction. The nature of this slow response does not appear to be well understood at the present time. Bremer<sup>16</sup> thought that it was a "neuromuscular contracture" similar to that which he demonstrated in normal frog muscle when stimuli of long duration were employed. He also believed that there was, in addition, a minor slowing of the true twitch. Just as in normal frog muscle, the "contracture" in denervated mammalian (cat) muscle was best obtained with currents of relatively long duration. Bremer observed that the contracture component in normal frog muscle was fatigued more easily than the twitch component; the same is true of the slow contraction phase of denervated mammalian muscle (Ravint<sup>17</sup>). Rushton<sup>18</sup> noted

a prolongation of the twitch of normal muscle stimulated with currents of long duration and ascribed to it progressive recruitment of additional fibers as the current continued. Recently Doupe<sup>19</sup> has shown that the prolonged contraction of denervated human muscle may or may not be obtained, the result depending on the temperature of the muscle and the duration of the stimulating current. This author attributed the prolonged contraction to a repetitive response to a constant stimulus, so that in effect what is produced is a true tetanic response. The fact that the prolonged contraction is accompanied by action potentials (Doupe<sup>19</sup> and Rosenblueth<sup>20</sup>) is against the contracture theory. For theoretical reasons, one would expect repetitiveness to occur in denervated muscle because it is a tissue with a very slow accommodation. On the other hand, if the prolonged contraction was due to repetitiveness and was a true tetanus, one might reasonably expect the tension developed to be higher than that of a twitch. However, Bremer found that, although the "contracture" could produce considerable shortening in an unloaded muscle, it developed very little tension when contracting isometrically—generally less than 20 per cent of that developed by a maximal twitch. If repetitiveness was occurring, (a) only a small proportion of the muscle fibers were involved, (b) the individual fibers were responding asynchronously at relatively slow rates or (c) there was a fundamental difference in the tension developed by repetitive responses to a constant stimulus and that developed in response to repeatedly changing external stimuli. Recently Skoglund<sup>11</sup> has shown that with very slowly rising stimuli, accommodation breaks down in normal motor nerves and repetitiveness begins to occur. A similar process may well occur in denervated muscle.

The immediate importance of these considerations for us lies in the fact that it is necessary to realize that different types of stimulation produce different types of responses, the nature of some of which is not well understood. It is quite possible that the nature of the response produced has an important bearing on the success or failure of the electrical stimulation of muscle.<sup>5</sup>

*C. The Question of Selective Stimulation and Pain.* — Two practical points to consider in the clinical use of electrical muscle stimulation are (a) the ability to stimulate denervated muscle selectively without activating neighboring normal muscle, and (b) the ability to minimize the sensory effects, since these will ultimately determine the amount of current a patient will tolerate. Lapique introduced the slowly rising, "progressive" current for selective stimulation. Its use was based on the difference in minimal current gradient of normal and denervated muscle. Thus a denervated muscle will respond to a slowly rising current at an intensity which is insufficient to stimulate normal muscle. Such currents have been employed clinically by Turrell.<sup>21</sup> The question of pain has been considered by Kowarschik and Nemec<sup>22</sup> and by Turrell. The former authors designed a special "thyatron" current for stimulating denervated muscle.

*D. The Adaptation of the Stimulating Current to Denervated Muscle.* — From the considerations discussed, this involves (a) the adaptation of individual current pulsations to the lowered excitability of denervated muscle and (b) the repetition and "surging" of these impulses to obtain a smoothly graded tetanic contraction. The first of these involves (a) an increase in the duration of each pulsation to allow for the lengthened chronaxie and (b) a slowing of the rate of rise of each pulsation to allow for selective stimulation. In regard to the second problem, denervated muscle will tetanize at a lower frequency than normal muscle.

*E. The Use of Sinusoidal Alternating Current.* — When the properties of

sinusoidal alternating current are examined, they appear to be particularly well adapted to muscle stimulation. For example, by lowering the frequency, we increase the duration and slow the rate of rise of each half-period. Both of these changes are advantageous in the stimulation of denervated muscle. The possibility of using a 60 cycle sinusoidal current was briefly considered by Kowarschik and Nemec.<sup>22</sup> They preferred, however, to use impulses of instantaneous rise. In this, they neglected to consider the relatively flat minimal gradient in denervated muscle. Experiments in our laboratory have shown that the optimum frequency for stimulation with sinusoidal alternating current is different for denervated muscle from that for normal muscle. Also, the optimum frequency depends on the index of response used in evaluating it. This fact has important theoretical and practical implications, which will be discussed in a separate communication. It provides a basis for selective stimulation.

## The Apparatus

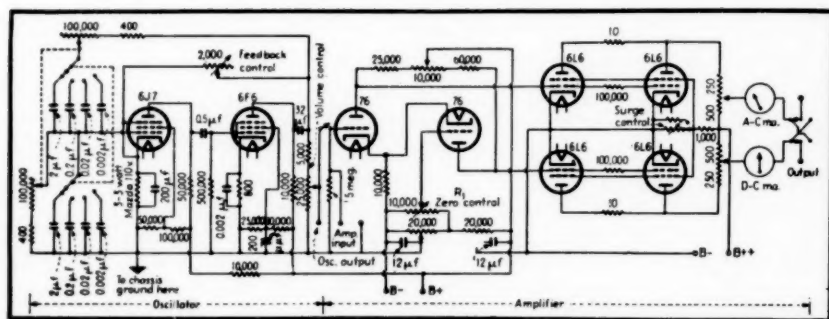


Fig. 1. — Circuit diagram of wide range R C oscillator and amplifier. A type 5Z4 is used in the power pack for the oscillator, and a type 83 serves the amplifier, both being connected for full wave rectification in conventional circuits not shown. The circuit was designed by Eugene Mittelmann (see *Electronics* for December, 1943).

The circuit diagram of the instrument is shown in figure 1. It consists essentially of two main units, an oscillator and an amplifier, served by two power pack circuits.

*Oscillator Circuit.* — The two tube resistance-capacity oscillator has a frequency range of 1.8 to 180,000 cycles per second and employs a circuit that is conventional except for the fact that frequency adjustment is accomplished by variation of the resistance branches of the frequency-determining RC bridge rather than by variation of capacitance. The main advantage of this procedure is the instrument's ability to cover a relatively wide range of frequencies on a single scale.

If rheostats are selected with sufficiently high wattage value, the accuracy of reproduction of the initial calibration is about as high as that of oscillators using variable capacitors.

Lower frequencies down to a fraction of a cycle per second can be obtained with the equipment. The method used will be described in connection with the chronaxie-measuring device.

Frequency multiplication is obtained by changing the values of the fixed capacitors in both capacitance arms of the frequency determining bridge. Four scales in decimal multiples cover the entire frequency range. In each range the ratio of the maximum to minimum frequency is 100 to 1 (1.8 to 180, 18 to 1,800, 180 to 18,000, 1,800 to 180,000). A wide frequency band can be explored in each range. Thus the necessity of changing switches during an investigation is, as far as possible, avoided.

A variable feed-back control is provided between the first and second tubes. This serves two purposes: first, to secure stable oscillation over extreme frequency ranges and, second, to change the wave form. Variable feed-back allows the arbitrary setting of any wave form between a square wave and a sinusoidal wave. The change in amplitude which necessarily must accompany change of feed-back in certain regions can be compensated for by use of the volume control between oscillator and amplifier.

*Amplifier Circuit.* — A switching arrangement in connection with a terminal block between oscillator and amplifier allows a choice between oscillator input and that from an outside source.

The amplifier input stage contains two type 76 tubes, one serving as a phase inverter and the other as a voltage amplifier, feeding four 6L6 tubes in push-pull parallel. The phase-inverting stage and the output stage are so balanced that for zero voltage across the input terminals of the amplifier input both the alternating and the direct current component in the output stage are zero.

The direct current component in the output stage is the differential current of the two push-pull stages. A variable rheostat,  $R_1$ , allows a shift of the direct current component toward either positive or negative values. This feature of the instrument may be used to obtain output currents in which a direct current component is superimposed on the alternating current.

The output leads of the final amplifier are in series with a direct current milliammeter and a thermocouple type alternating current instrument. When symmetrical voltages are impressed on the amplifier input, the direct current instrument will show zero reading for any value of alternating current indicated by the thermocouple instrument. Similarly, any direct current component which is imposed on the output by means of rheostat  $R_1$  is indicated both as to amplitude and as to polarity by the zero center direct current instrument. This instrument also indicates the degree of asymmetry of wave forms. The meters thus provide a quick check of wave forms, to supplement the oscilloscope ordinarily across the output.

*Surging Arrangement.* — Surging is accomplished by periodically changing the screen grid voltage of the four tube output stage.

The variable resistance marked "surge control" is in series with a 1,000 ohm fixed resistor. The variable resistor is of the continuous wound type, with a slider capable of rotation without interruption. During each full 360 degree rotation the resistance between any fixed point on the circumference of the variable rheostat and the rotating slider will reach zero once and pass through a maximum value once. The maximum resistance is so selected that in connection with the 1,000 ohm fixed resistor it will provide the proper screen grid voltage for maximum output of the four beam-power tubes. A switching arrangement permits replacing of the rheostat with a fixed resistor providing maximum output.

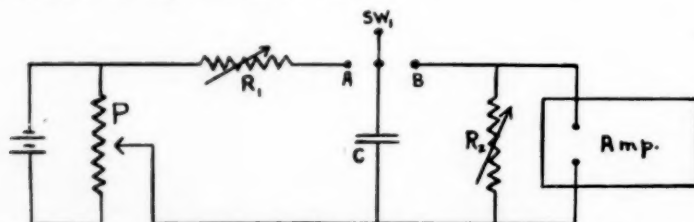


Fig. 2. — Circuit for obtaining condenser discharges of different time constants.

*Condenser Discharges and Exponentially Rising Currents.* — The principles involved are best explained by reference to figure 2. When the double throw



switch,  $SW_1$ , is in position  $A$ , the condenser  $C$ , is charged to a voltage determined by the setting of potentiometer  $P$ . When  $SW_1$  is now moved to position  $B$ ,  $C$  discharges through  $R_2$  at a rate determined by the product  $R_2C$ . The resultant current obtained in the amplifier output is a condenser discharge of time constant  $R_2C$ . The form of the output current is independent of the resistance and capacitance of the load.

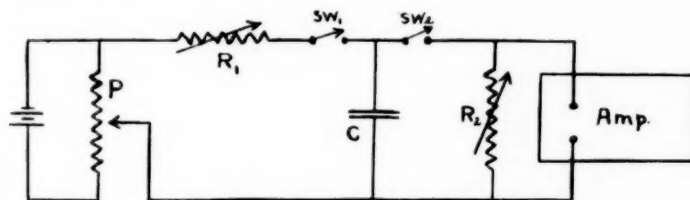


Fig. 3. — Circuit for obtaining exponentially rising currents.

*Exponentially Rising Currents.* — In figure 3,  $SW_2$  is closed. When  $SW_1$  is now closed, condenser  $C$  charges at a rate determined by time constant  $R_1C$ . An exponentially rising current will be obtained in the output of the amplifier, the polarity of the current being determined by the polarity of the connection across the input terminals. After the current reaches a steady value, switch  $SW_1$  may be opened, permitting  $C$  to discharge through  $R_2$ . The current in the amplifier output then falls to zero at a rate depending on the values of  $R_2$  and  $C$ .

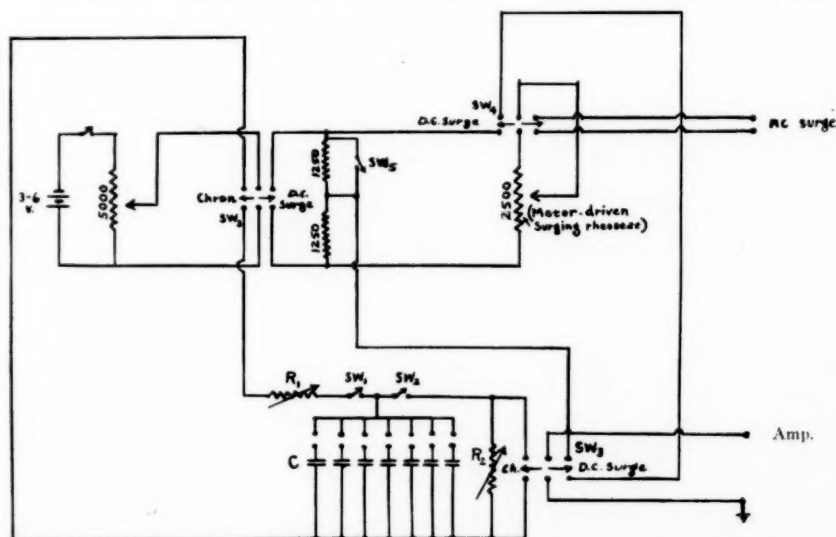


Fig. 4. — Details of circuit for obtaining condenser discharges and exponentially rising currents.

The detailed diagram of the equipment for obtaining these currents is shown in figure 4. The battery is shunted by a 5,000 ohm potentiometer to allow arbitrary selection of current amplitudes for the chronaxie measurement. The time constant both for decreasing and for increasing currents can be adjusted by changing the values of  $C$ ,  $R_1$  and  $R_2$ . A four pole, double throw switch,  $SW_3$  (shown in two parts for clarity), allows the battery to be used as the driving source for chronaxie measurements or as a variable amplitude, reversible polarity, direct current source for the amplifier.

The surging rheostat used for changing the screen grid voltage of the amplifier output tubes can be switched over to perform a similar function for surging the direct current output, with switch  $SW_4$  being provided for this pur-

pose. The motor-driven surging rheostat forms a bridge circuit together with two 1,250 ohm resistors. With the slider of the surge rheostat in the center position, the bridge is balanced and no voltage appears across the amplifier input terminals. According to the position of the rotating arm, the potential across the input varies between a positive and a negative extreme, yielding an alternating current of very low frequency (as low as 0.08 cycles per second) determined by the speed of the driving motor. The speed of the motor is variable in a wide range. One arm of the fixed ratio bridge is shunted by switch  $SW_3$ , allowing the short circuiting of one of the 1,250 ohm resistors. If this is done, the polarity of the surging current does not change but the amplitude varies between a maximum and a minimum.

*Direct (Galvanic) Current.* — This is obtained from the circuit employed in obtaining condenser discharges or exponentially rising currents, the condensers being switched out of the circuit. Make and break galvanic current can be obtained by operating a key.

### Summary

Some of the physiologic principles involved in the design of an apparatus for the complete experimental study of electrodiagnosis and electrotherapy are outlined.

An apparatus developed for such a study is described.

Some results obtained with the aid of this apparatus are to be published in a separate communication.<sup>5</sup>

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## INDUCED RESISTANCE TO PROLONGED SUN EXPOSURE \*

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Despite the healthful aspects of the sun's rays, these rays can be annoying and even harmful. Persons exposed to the summer sun of temperate climates, to the tropical sun or to the desert sun may be adversely affected. In altitude flying, on snow-capped mountain peaks and on sandy beaches of lake or sea, the direct or reflected rays of the sun may cause injurious effects. Men in submarines, as well as those below decks on large ships, who have been screened from daylight for long periods at a time, are unable to endure sudden prolonged exposures to the rays of the sun. Among persons with a naturally low cutaneous toleration to sunlight, who are unable to build up a relative immunity to the sun's rays, are redheads, blonds and others with thin, sensitive epidermis.

In addition to the well known first and second degree sunburn (dermatitis actinica or erythema solare)<sup>1</sup> with its erythema and enervating effect, there is the severe burn, with swelling, blistering, subsequent itching, peeling and even exudation, preceded in many cases by general malaise, weakness, dizziness, headache, nausea, vomiting and fever. This type of reaction is not uncommon in Florida in the summer and in the arid parts of California. Here, too, there may develop miliaria, or prickly heat, due to excessive sweating caused by an acute inflammation of the sweat glands and characterized by patches of small red papules and vesicles, with intense itching and burning of the skin. In the desert, also, an ulceration, the so-called desert sore, may develop. Some persons are subject to herpes, urticaria, hydroa vacciniforme (a disease of young people, marked by the development of vesicles on patches of erythema and often associated with porphyria, which recurs every summer) and xeroderma pigmentosum.<sup>2</sup> The last named is a disease of childhood, usually fatal, that seems to be actually caused by sunburn; at least the characteristic hyperpigmentation, keratosis, telangiectasis and epithelioma are initiated by a bad sunburn. The earliest manifestation is freckles which become larger and darker and undergo malignant changes.

### Developing a Relative Immunity

Recent experiments, of importance to the war effort, indicate that men can become gradually accustomed to heat and exertion. It is known that the average person can, similarly, become gradually adapted to sunlight and thus protected against the effects of exposure to large amounts of the sun's radiation.<sup>3</sup> It is important from the standpoint of this study to learn whether such resistance can be furnished to the person with light skin or with average skin texture by artificial ultraviolet radiation.

Some persons cannot get a tan or develop a relative resistance to natural sunlight. Others are unable to take the time for graduated exposures. Can something be done to protect such persons from sunburn or from some of the abnormal cutaneous or general reactions mentioned?

We have been interested in developing a method by the use of small graduated doses of artificial ultraviolet radiation given by the mercury vapor quartz lamp, that might help prevent sunburn and its complications. The treatments, given three times a week, can be started a month or two before exposure to natural sunlight is to take place.

\* The opinions and assertions contained herein are the private ones of the writer and are not to be construed as official or reflecting the views of the Navy Department or the naval service at large.

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Ships, submarines, mobile hospitals and base hospitals can have the usual unit for single treatments, or many men can be treated at one time by the use of solarium "showers" and ultraviolet ray "baths." Quick single treatments can be given by the "wave" technic with the high voltage cold quartz mercury vapor generator. In such treatments the detachable reflector with the quartz "burner" is slowly passed by hand over the body of the patient, contact with the skin being just barely avoided. As many as 15 men can be easily and quickly treated in three to five minutes by the solarium "showers."

### Some Practical Points

The harmful results of excessive exposure to the sun's rays are due particularly to the ultraviolet band on the sun's spectrum at approximately 290 to 320 millimicrons. The shorter ultraviolet rays cannot reach the surface of the earth because they are absorbed by the dust and the humidity of the atmosphere. Artificial ultraviolet radiant energy includes the spectral emissions 290 to 320 millimicrons. It is now generally accepted that the thickness of the horny layer of the skin and not pigmentation offers the greater protection.<sup>4</sup> Pigmentation aids in resistance to solar energy to a much less degree than was formerly believed to be the case. Presumably, then, brunets and Negroes owe their better protection to the thicker structure of their epidermis. If the epidermis can be thickened in the brunet, the redhead or the blonde by artificial ultraviolet emissions, why cannot this produce a relative immunity against exposure to outdoor sunlight as it does against exposure to the radiant energy of the mercury vapor quartz lamp?

To determine the approximate differences in tolerance to the hot quartz mercury arc of 105 to 125 volts, 730 watts and 60 cycles, with an amperage at the start of 16 and when running of 13, we noted the length of time and the distance needed to cause a second degree erythema in persons of different complexions and found:

For an average redhead ten seconds at 36 inches was required.

For an average blond fifteen seconds at 36 inches was required.

For an average brunet thirty seconds at 36 inches was required.

For a darker brunet one minute at 36 inches was required.

For a Negro five minutes at 36 inches was required.

### Earlier Observations

During a number of years of work on the use of the artificial ultraviolet ray generator it occurred to me that persons who received artificial ultraviolet irradiation frequently mentioned that they could stay out in the summer sun for a longer period than was possible before they received this treatment. It was found that such treatment permitted the average brunet to stay out in the June sun for one to one and a half hours with only a slight erythema, whereas before the artificially produced ultraviolet radiation was applied an exposure of one hour would cause a second degree erythema lasting from five to seven days. In the previous three years I had noted that treatments with the cold quartz lamp of one minute at 18 inches given twice a week to four portions of the body of a person with normal skin sensitivity, with a dose increase of about one-half minute at subsequent treatments (the increase depending on the reaction), would in eight treatments produce a moderate but definite amount of relative immunity. Thus immunity could be increased up to two and three times that which was normal by a number of prophylactic artificial irradiations.

With this in mind I decided to check on the patients who already had

received treatment with the hot or cold quartz lamp and try to determine how much, if any, protection such prophylactic artificial irradiations would supply, especially to the person who was sensitive to the rays of the sun.

### Sources of Artificial Radiation

Despite much research it was 1916 before the first usable apparatus was manufactured that was capable of transforming a live current of electricity to the ultraviolet portion of the electromagnetic spectrum. The most commonly used are:

*Hot Quartz Mercury Arcs.* — The principal part is a quartz "burner" from which air has been exhausted and into which some mercury has been placed to form a pool at the cathode; either another pool of mercury or a tungsten rod is used for the anode. These burners must be tilted to start the current by the resultant flow of mercury. Once contact is established, some mercury vaporizes and starts the arc. Ten minutes is needed before enough mercury is vaporized to produce rays in therapeutic quantities. The air-cooled lamp is used chiefly for general irradiation of the human body.<sup>5</sup>

In the newer types, solid cathodes are employed and very little mercury is used. The quartz tube contains a small amount of argon gas. As soon as the current is turned on the argon conducts it through the tube, which lights at once. The small amount of mercury vaporizes promptly, and thus there is practically no waiting period. The current used is 220 (low voltage) alternating current provided by a transformer from ordinary 110 alternating house current.

Hot quartz lamps emit little infra-red radiation, a fairly large amount of visible violet radiation and a large amount of ultraviolet radiation, of which 6 is far ultraviolet (less than 290 millimicron units), 28 per cent total ultraviolet (250 to 390 millimicron units), 20 per cent luminous (390 to 770 millimicron units) and 52 per cent infra-red (1,400 to 15,000 millimicron units). The 6 per cent shorter than 290 millimicron units is entirely absent in sunlight and has a high germicidal value.

*The Cold Quartz Ultraviolet Lamp.* — A narrow tube containing neon and mercury is lit by a current of about 2,500 volts (high voltage) and extremely low amperage. Very little heat is produced and direct contact is possible, as with the water-cooled "Kromayer." The ultraviolet radiation is about 55 per cent (95 per cent of which is of 254 millimicron wavelength), 10 per cent is visible light and 35 per cent in infra-red.<sup>6</sup> It is both antirachitic and germicidal and produces erythema, but with little pigmentation.

The usual dose with a hot quartz lamp at the start is twenty to thirty seconds at a distance of 36 inches, and the time is gradually increased according to the reaction. Remember the "law of inverse square." A decrease of one-half the distance from the patient to the burner usually means an increase of four times in radiation strength.

### Report of Cases

Three cases will be reported as examples of the reaction to solar radiation after a series of hot quartz lamp applications of ultraviolet radiation.

CASE 1. — H. B. M., a man aged 28, had red hair, blue eyes and fair skin. He had always been subject to serious burning from exposure to the summer sun for more than fifteen minutes. All efforts to secure a tan by a series of graduated sun baths had been unsuccessful. When going out in the sun he had to wear a wide-brimmed straw hat and a shirt with long sleeves. At the age of 13 he was out in the summer sun for one hour with subsequent vesiculation, peeling, pain and edema of the limbs which prevented him from sleeping for a week.

On April 16, 1943 he began receiving treatments with the ultraviolet ray hot quartz lamp. The lamp used was of 105/125 volts, 730 watts and 60 cycles, with an amperage of 16 at the start and of 13 when running. The treatments were given three times a week. The first irradiation, for fifteen seconds at 36 inches, caused a third degree erythema, but after a series of treatments of increased doses (table 1), the pa-

TABLE 1. — *Treatments in Case I.\**

Date	Duration	Distance (Inches)	Date	Duration	Distance (Inches)
April 16	15"	36	June 8	1'45"	18
April 23	15"	36	June 11	1'45"	18
April 26	15"	36	June 14	2'	18
April 29	15"	36	June 17	2'30"	18
May 1	30"	36	June 20	2'45"	18
May 4	30"	36	June 22	3'	18
May 7	30"	36	June 25	3'15"	18
May 9	45"	36	June 27	3'30"	18
May 11	45"	36	June 30	3'45"	18
May 14	1'	36	July 2	4'	18
May 16	1'15"	36	July 5	4'	18
May 18	1'30"	36	July 8	4'15"	18
May 20	1'45"	36	July 11	4'30"	18
May 23	2'	36	July 15	4'45"	18
May 25	30"	18	July 18	5'	18
May 28	45"	18	July 21	5'	18
May 30	1'	18	July 24	5'15"	18
June 2	1'15"	18	July 27	5'30"	18
June 5	1'30"	18	July 30	6'	18

\* The first treatment caused a third degree erythema; the other treatments, only mild erythema.

tient's skin became sufficiently resistant to permit him to take the radiation for six minutes at 18 inches without having more than a second degree erythema.

At a distance of 18 inches from the hot quartz generator, according to the inverse square law, twenty-four minutes would be the comparable exposure time required for the original 36 inches. This figure gives one an idea how much it was possible to increase the treatment time in the case of a person abnormally sensitive to active radiation, natural or artificial.

In May the patient began to expose himself to the sun's rays twice a week, starting with an hour at his first session. He suffered no burn or blister, and his skin gradually assumed a light tan, became more resistant and was unaffected even when, in June and July, he played tennis in the sun for three or four hours. He continued with his hot quartz treatments during the time he took his outdoor sun exposures.

The patient has been taking treatments of from five to six minutes since August, 1943 without acquiring more than a mild erythema and a slight brownish-pink "tanning" of the skin.

CASE 2. — C. H. A., a man aged 22, with red hair and light skin, came to the department Jan. 11, 1944 for intensive ultraviolet ray treatment for acne. He had never been able to develop a tolerance to the sun's rays. He stated that because of acne vulgaris he had received treatments with the cold quartz mercury vapor arc for six months starting in April, 1943. For the first time in his life he had then been able to stay out on the beach in a bathing suit for half an hour without vesiculation or peeling. He never had had a "tan" before but now was able to develop one and stay outdoors as long as two and one-half hours without any untoward effects.

CASE 3. — A white woman aged 22, a blue-eyed blond with fair, delicate skin, had always been very sensitive to sunlight and burned severely with only fifteen or twenty minutes of exposure to the summer sun. She had never been able to build up a resistance to the sun's rays. With careful exposure, she would get a slight "tan," but if she did not receive any exposure for two or three days the tan would disappear completely and sun bathing for tolerance or tan would have to start all over again.

On May 1, 1943 the patient began taking ultraviolet ray treatments with the hot quartz lamp three times a week. The first treatment lasted fifteen seconds, and fifteen seconds was added every other day until the treatments were of four minutes at 36 inches (table 2). The patient then had an irradiation once a week.

TABLE 2. — *Treatments in Case 3.\**

Date	Duration	Distance (Inches)	Date	Duration	Distance (Inches)
May 1	15"	36	May 28	3'	36
May 4	30"	36	May 30	3' 15"	36
May 7	45"	36	June 2	3' 30"	36
May 9	1'	36	June 5	3' 45"	30
May 11	1' 15"	36	June 8	4'	36
May 14	1' 30"	36	June 15	4'	36
May 16	1' 45"	36	June 22	4'	36
May 18	2'	36	June 29	4'	36
May 20	2' 15"	36	July 6	4'	36
May 23	2' 30"	36	July 13	4'	36
May 25	2' 45"	36			

\* The only reaction to treatment was a mild erythema.

In July she played tennis and was exposed to the noonday sun for over two hours, although she had not been exposed to sunlight previously during the summer. Ordinarily this would have caused a very severe burn. However, she acquired only a slight redness of the skin, with no soreness.

Two of the patients volunteered the information that they had been free of colds since taking treatments.

### Summary

Since thickening of the startum corneum occurs with artificial ultraviolet irradiation as well as with solar irradiation, it is postulated that treatments with the hot or cold quartz mercury vapor arc may be useful as a protection against excessive exposure to the rays of the sun.

Such protection is particularly important to the person with light, tender skin or with any other form of sensitivity to solar radiant energy.

If large numbers of service men needed this protection, mass treatments could be given with little cost to the government or loss of time from duty.

More proof is needed, but both the evidence at hand and the practical importance of the subject to the men fighting a global war justifies further investigation.

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## PSYCHOBIOLOGIC FACTORS IN THE KENNY CONCEPT OF INFANTILE PARALYSIS \*

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The introduction of the Kenny concept and treatment of infantile paralysis has stimulated interest in the structural and physiologic changes produced by the virus of infantile paralysis in the neuromuscular system. In addition it has emphasized once again the insufficiently appreciated obligation of physicians to "treat not only the disease but the patient as well." This obligation is not merely to reassure the patient and make him as comfortable as possible emotionally and physically. It has a far deeper significance, which is rooted in the basic laws of biology. The Kenny principles remind us that physicians still are biologists fundamentally, that the human organism in its completely integrated state of functioning is subject to the same fundamental biologic laws of stimulus (including disease or injury) and reaction as are all other forms of life. Since a thoroughgoing understanding of man as a biologic unit is impossible without consideration of his personality functions, and since man has a special ability to study his own personality functions, the discipline psychobiology has been introduced into the framework of biology and medicine. Psychobiology is subject to the same basic laws as is biology. It differs only in its special technics for observation, experimentation and treatment developed because of the complex nature of the personality functions. It is the purpose of this report to see wherein the Kenny concept of infantile paralysis utilizes the principles of psychobiology and also how neglect of psychobiologic principles confuses and obscures our understanding of the clinical picture of the disease. Psychobiology shares with other fields of medicine a common interest in making clear the direct effect of the virus of infantile paralysis on special organs. It is, however, particularly concerned with that portion of the clinical picture of infantile paralysis which constitutes the total organismic (not merely neuromuscular) reaction to the pathologic stimulus of organic disease.

A second fundamental law of biology is that the two great divisions of living things, plant and animal life, are differentiated by the factor of subjectively initiated motility. The property of motility in animal life varies widely from the simple functions of amebic pseudopodia to the highly complex functions of muscular activity in man. The function of muscular activity lends itself to psychobiologic study because of its direct relation to the personality functions. Furthermore, by virtue of the location of the muscular system close to the surface of the body, muscular activity, unlike the functions of the circulatory or gastrointestinal systems, for example, is easily available for direct observation. Muscular activity is constantly in the service of the personality functions, so that varying patterns of muscular activity may be differentiated, not only as functions of the neuromuscular system but as functions of personality. It is known from some preliminary psychiatric studies<sup>1</sup> that correlations exist between the personality functions and different types of muscular activity. We may consider, for example, groups of persons whose occupational muscular activities are directed in dif-

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ferent ways to the immediate objective of appealing visually to an audience (e. g. dancers). In addition to a widely varying visual appeal to audiences, these specific patterns of muscular activity can be correlated with variations in underlying personality traits and strivings rising from within the individual. Even the more subtle variations in posture, gesture and facial expression which occur in everyday life can be correlated with underlying personality factors. It is, therefore, not surprising that widespread and intricate psychobiologic reactions should occur as a result of a disease process affecting that system which is so significant phylogenetically and which plays such an important role in the personality functions. It is even possible that variations in psychobiologic reaction possessing an ontogenetic significance will be found in adults as compared with children. In the development of the various bodily systems other than the neuromuscular system, the main feature of development after birth is increase in size. The neuromuscular system, however, in addition to an increase in size has still to undergo many years of functional development. Pohl and Kenny<sup>2</sup> stated that a small child is still largely an automatic mechanism with little selective control of muscle and that, therefore, there is less tendency for substitution of muscle and incoordination of muscle action to develop. Selective control of muscle is influenced markedly by personality factors as the individual develops from birth to adulthood. If, however, the neuromuscular system were as completely developed functionally at birth, or shortly thereafter, as, for instance, are the circulatory and respiratory systems, there would be little opportunity for the personality strivings to find essential outlets. The slowly developing neuromuscular system is a most important outlet for the personality functions.

Miss Kenny was the first to treat patients with infantile paralysis from the point of view that the neuromuscular system is subject to the influences of psychobiologic reactions resulting from the pathologic stimulus of the disease. Prior to the introduction of her concept of infantile paralysis, medical men paid little or no attention to this psychobiologic aspect of the disease. Instead, attention was focused specifically on "paralysis," which was presumed to bear an absolute relationship to the destruction of anterior horn cells. That this specific relationship between paralysis and anterior horn cell disease had never been proved conclusively and was largely presumptive has been demonstrated by Toomey,<sup>3</sup> who showed that a complete clinical recovery may take place in spite of the presence of a marked and permanent destruction of anterior horn cells. Toomey concluded that in accordance with a general rule of nature an abundant cellular reserve is available to take over the function of those cells which have been destroyed. This, no doubt, is true so far as it constitutes a single pathologically observable factor occurring in a chain of events. However, the fact that many, if not most, patients with similar destruction of anterior horn cells fail to show such recovery unless treated by some reeducative method suggests that an additional explanation on a psychobiologic basis is required.

With the advent of the Kenny concept of infantile paralysis it became evident that in addition to the symptom "paralysis" there are three other symptoms, identified by Miss Kenny as "muscle spasm," "mental alienation" and "muscular incoordination." These also must be dealt with therapeutically. Of the four symptoms now recognized, it appeared that two, "paralysis" and "spasm," were due to the direct effect of the disease process on the neuromuscular system. The other two, "mental alienation" and "muscular incoordination," appear not to be due to the direct effect of the disease process but to represent psychobiologic reactions to the disease.

"Mental alienation" evidently constitutes a dissociative mechanism which can be differentiated into two distinct though related symptoms. These are psychosensory (proprioceptive) dissociation and psychomotor dissociation, which correspond, respectively, in the Kenny terminology, to "loss of mental awareness" and "mental alienation" (in its narrower motor sense).<sup>4</sup> Unless psychobiologic factors such as these are borne in mind by individual investigators, it is evident that a disproportionate emphasis on the effects of cellular pathology will prevail.

Recently, Moldaver,<sup>5</sup> on the basis of chronaxia measurements, reported that "in all 'alienated' muscles there was evidence of neuromuscular degeneration. In most of the 'alienated' muscles the nerves and muscles were in a state of partial neuromuscular degeneration. . . . Some of the muscles considered 'alienated' according to the definition of Kenny, were found in total neuromuscular degeneration." He pointed out further that "in partial neuromuscular degeneration, some of the muscle and nerve fibers are damaged, while other fibers escape degeneration." His conclusion is that the symptom "mental alienation" is due to the anterior horn cell disease and presumably indistinguishable from true paralysis. It is important to draw a clear line of distinction between that which is accepted as evidence of paralysis and that which is evidence of "mental alienation." Chronaxia measurements yield evidence only on purely physiologic phenomena and therefore cannot be expected to reveal a psychobiologic dissociation such as "mental alienation" any more than they reveal a similar dissociation (though of different causation) such as occurs in hysteria. Only true paralysis can be evidenced by this method, whereas the best evidence of "mental alienation" lies in the response to reeducation. Moldaver made the observation that not all fibers in a disabled muscle are paralyzed. This, together with the fact of Kenny's results from reeducation on similarly affected muscles, seems to indicate that "mental alienation" and paralysis may be coexistent in the same muscle and that it is the unparalyzed but "alienated" element in a given muscle which responds to the reeducation phase of the Kenny treatment. The paralyzed element may remain in evidence electrically, while its clinical manifestations are overshadowed by the restoration of function in the "alienated" or dissociated element. The extent of clinical improvement depends on the relative proportions between "alienated" and paralyzed fibers in a muscle and on the ability of the patient as a psychobiologic unit to respond to reeducation. If, however, all fibers are actually paralyzed by anterior horn cell disease or if complete fibrosis resulting from prolonged immobilization due to splinting or untreated "mental alienation" has developed, no amount of reeducation will restore function.

Although the Minneapolis group has never denied the occurrence of paralysis, they have, apparently under the influence of Miss Kenny, tended to minimize its importance in the clinical picture of infantile paralysis. This tendency undoubtedly arises from the realization that nothing is to be accomplished by treating a symptom which is the direct result of an irreversible structural lesion, whereas there is much to be gained by focusing attention on a reversible symptom which has proved amenable to treatment. The tendency, however, to minimize the importance of paralysis has been unfortunate. It has helped create a controversial situation in which much energy is being expended to prove on the one hand that paralysis and on the other that "mental alienation" is the disabling symptom, whereas the essential problem is to what extent each plays a role. Nevertheless, much new data have resulted from this controversy, and it is increasingly apparent that the arguments are much more in agreement than are their respective

proponents. Although there is sufficient well substantiated evidence that both symptoms do exist, there are many wide gaps in our knowledge of each.

The crux of the whole controversy over the Kenny concept lies in the fact that one group of observers, principally the Minneapolis group, is using psychobiologic methods of observation, experimentation and treatment and therefore brings into view only those of phenomena which exist at the psychobiologic level of organismic integration. The other group, using more purely physical methods of study, brings into its field of vision only those phenomena which exist at the anatomic-physiologic level of organismic integration. Both groups tend to lose sight of the fact that the two symptoms may be coexistent not only in the same individual but in the same muscle. It is important to subject the method of procedure to critical study before attempting an evaluation of the facts, a principle somewhat more rigidly adhered to in laboratory investigations than in clinical investigation. Each item of new data extracted by an individual worker bears a specific relationship to the method used. Kenny's methods, for example, have been those of empiric clinical observation, experimentation and treatment, and the relative values of her findings have thus far been measured in terms of clinical results. Since she has taken as her exclusive object of study the patient as a constantly reacting psychobiologic unit, her findings may also be measured in terms of the psychobiologic organization of the individual. Careful psychiatric studies of patients will undoubtedly provide another basis for measurement in terms of their respective variation in personality functioning. Even though she neglects other anatomic and physiologic data and thereby has a limited concept of the disease, her findings are to be reckoned with on a psychobiologic basis. Failure to do justice to her clinical orientation and background accounts for the frequent though somewhat contradictory statement in the literature that, although her concept of infantile paralysis forms the basis for an excellent method of treatment, it does not accord with known facts concerning the disease.

Watkins and his co-workers,<sup>6</sup> using electromyographic methods, found that, whereas normal resting muscles do not yield spontaneous electrical discharges, such discharges are always found in weakened muscles and are probably evidence of regeneration. Completely paralyzed muscles produce no spontaneous discharges. They concluded, therefore, that weakness is not due to "alienation" and that the term "alienation" is unnecessary. The first part of this conclusion is quite in agreement with Pohl and Kenny,<sup>2</sup> who have always maintained that, except for the weakness of disuse, weakness is not a feature of "mental alienation." Despite their conclusion that the term "mental alienation" is not necessary, Watkins and co-workers pointed out that loss of volitional control is found in infantile paralysis as well as in other immobilizing conditions. This observation supports rather than weakens the contention that some such factor as "mental alienation" or dissociation does play an essential role.

The method employed by Watkins and his group can yield only anatomic and physiologic data, namely, data on complete paralysis (absence of spontaneous electrical response) and neuromuscular degeneration and regeneration, not on the psychobiologic dissociative symptoms of "mental alienation." Here again, it is not the facts which are in disagreement. Conclusions must be consistent with the methods used, and one cannot prove the nonexistence of one factor by proving the existence of another. Although regenerative neuromuscular changes may play a role in the ultimate results of the Kenny treatment, the day by day correlation of improvement with reeducation is

indicative of the preponderant role played by psychobiologic factors in the clinical picture of the disease.

Watkins and his group also made painstaking studies of "muscle incoordination." They found that even in patients who were receiving muscle reeducation designed specifically to avoid "incoordination," simultaneous contraction of opposing muscles could be detected electrically although not suspected on observation of the muscles in action. They were unable to produce this synchrony of discharge in normal muscles but succeeded in doing so during the regeneration of peripheral nerves after injury. They concluded that this symptom represents a physiologic disturbance similar to that following wallerian degeneration and proposed the descriptive term of "disordered reciprocal innervation" for the phenomenon.

It is evident from this portion of their studies that "muscular incoordination" as originally described clinically by Kenny must now be differentiated into at least two factors; namely, "disordered reciprocal innervation," to use the term proposed by Watkins, and what has long been recognized as "substitution" of muscle action. Pohl has recognized a similar differentiation clinically and prefers to draw a clear line of distinction between "incoordination" and substitution. It must be borne in mind, however, that as originally described and treated by Kenny, "incoordination" includes substitution. That the two are difficult to distinguish clinically, though very different etiologically, is borne out by the observation of Pohl that failure to control substitution will lead to further "incoordination." Thus, in "incoordination" a physiologic component is differentiated from a psychobiologic one.

Substitution which leads to clinical "incoordination" but not electrical "incoordination" results from the attempt of the total organism to adjust to a handicap. For example, a task involving muscular effort is to be performed by the afflicted person. One patient, according to personality make-up and age, may accept passively his disability and make only a limited effort to accomplish the task. Another, who places a greater value on accomplishing the task, will put forth a more strenuous effort, involving the use of muscles not originally intended for the task at hand. Multiplication and repetition of such substitution will eventually lead to the pattern of incoordinate clinical muscular activity described by Kenny. Psychiatric studies,<sup>1</sup> as yet incomplete, of patients with long-standing infantile paralysis as well as with other muscle disabilities, have shown that this initial effort at substitution is only the first of a long series of difficult and complex adjustments and substitutions which the untreated patient will have to make throughout the remainder of his life.

"Muscle spasm," which is usually accompanied by pain, is still the least understood of the three symptoms stressed by Kenny. Whether it is the normal reflex response of healthy muscle to its "paralyzed" opponents or whether the spastic muscle is a major site of the disease process, causing secondary "mental alienation" in its opponent, a number of other factors have been suggested as well.<sup>5-6</sup> Although Pohl stresses the importance of protecting the patient from fear, the possible role that anxiety may play in the production of spasm has not been considered in the literature and needs investigation.

For a discussion concerning the psychobiologic factors in the reeducation phase of the Kenny method the reader is referred elsewhere.<sup>4</sup> Pohl and Kenny<sup>2</sup> discuss the same factors from a technical therapeutic standpoint and describe in detail the method by which the patient is taught to develop a mental image of the muscle action to be accomplished. This is a specific function of the personality, wherein the proprioceptive functions of



the consciousness are associated with complex patterns of motor function. These, in turn, initiate impulses that eventuate in correspondingly complex contractions of individual muscles, parts of muscles and groups of muscles. Reassurance and suggestion are psychotherapeutic measures which help in the final achievement of efficient coordinated active motion.

### Summary

The accompanying table summarizes the evolution that has taken place in the concept of infantile paralysis as a result of the introduction of the Kenny principles of treatment. Before Kenny, the psychobiologic reaction to the disease was neglected and physicians attempted to deal only with "paralysis," which was thought to bear a direct relationship to destruction

*Evolution of the Present Day Concept of Infantile Paralysis.*

Before Kenny	Since Kenny	Present Status
Paralysis ✓	Paralysis _____	Irreversible anterior horn cell destruction (Anatomic)
		Reversible neuromuscular degeneration (Anatomic-physiologic)
	Spasm ✓ _____	Poorly understood physiologic disturbances (Physiologic)
		Anxiety (?) (Psychobiologic)
	Mental alienation _____	Psychosensory (proprioceptive) dissociation (Psychobiologic)
		Psychomotor dissociation (Psychobiologic)
	Muscular incoordination _____	"Disordered reciprocal innervation" (Physiologic)
		Substitution (Psychobiologic)

of anterior horn cells. The Kenny concept introduced three more symptoms for consideration. Of these three, spasm, like paralysis, appears to be a direct result of the disease process, although its exact significance is still much in doubt. The other two, "mental alienation" and "muscular incoordination," appear to be in the nature of psychobiologic reactions to the effects of the disease as well as to certain methods of treatment. Both of these symptoms respond to reeducation which, in large measure, is a psychotherapeutic procedure. As a result of the investigations now in progress, it appears that each of the four recognized symptoms may be broken down into definite component parts. Although clinically there is much overlapping and the lines of demarcation are blurred, it appears that the underlying significance of each of these component factors can be studied with a fair degree



of accuracy, provided they are studied by methods consistent with the biologic and psychobiologic significance of the individual factor under consideration. Actual paralysis apparently includes both the results of anterior horn cell destruction and varying degrees of neuromuscular degeneration. The understanding of "spasm" is in an unsatisfactory stage but may carry, in addition to a number of physiologic factors, an element of anxiety. "Mental alienation" may be subdivided into the psychobiologic symptoms of psychosensory (proprioceptive) dissociation and psychomotor dissociation. Finally, it appears that "muscular incoordination" may be considered a physiologic disturbance, for which Watkins and his co-workers have proposed the descriptive term "disordered reciprocal innervation," plus the psychobiologic component of substitution.

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### Electrical Stimulation in Denervated Muscle — Osborne, Et Al.

(Continued from page 344)

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# THE PRESENT STATUS OF ULTRAVIOLET BLOOD IRRADIATION (KNOTT TECHNIC) \*

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The Knott technic of ultraviolet blood irradiation consists essentially of the withdrawal and citration of a predetermined amount of a patient's blood and the immediate re-injection of the citrated blood through a Knott homoirradiator, a precision machine which automatically exposes the citrated blood safely and efficiently to high intensity ultraviolet rays and then returns it to the venous circulation of the patient. The procedure takes about fifteen to twenty minutes and a detailed account of it has been published frequently elsewhere.

The present status of this type of therapy can be best understood by reviewing the chief physiologic events observed to occur following its application by several independent workers in certain disease states. A recapitulation of these events is presented along with several theoretical considerations.

## Physiologic Events Observed After Ultraviolet Blood Irradiation Therapy

The chief physiologic events observed after ultraviolet blood irradiation are as follows:

I. *Rapid and Efficient Control of Bacterial Infection.* — In 1942 I<sup>12</sup> reported the results of this method in 151 consecutive cases of acute pyogenic infection; Rebbeck<sup>6</sup> reported the use of this method in the treatment of puerperal sepsis in 1941<sup>6</sup> and in 21 cases of postabortal sepsis in 1942.<sup>7</sup> In 1942 Hancock<sup>3</sup> reported the recovery of 8 consecutive patients with septicemia. In 1943 Rebbeck<sup>8</sup> reported recovery in 5 of 7 cases of *Escherichia coli* septicemia. In 1940 and again in 1943 Barrett<sup>9-10</sup> reported that in his opinion many severe infections were efficiently controlled by the use of the Knott technic. All workers agreed on the consistency and reliability of the Knott technic as a method for controlling acute pyogenic infections other than bacterial endocarditis, which failed uniformly to be influenced by this therapy.

It should be pointed out that the Knott apparatus is not designed to kill bacteria directly, as only one twenty-fifth of the total blood volume is irradiated. It is designed to apply ultraviolet rays to the blood in the optimum dosage. Furthermore, it has been known since 1924<sup>29</sup> that bacteria mixed with blood are not killed by ultraviolet rays directly. In other words, the clinical bactericidal effect is obviously not due to the direct lethal effects of ultraviolet rays but is due to a much more subtle mechanism, probably closely connected with ultraviolet ray metabolism.

II. *Control of Infections Due to a Virus or Viruslike Organism.* — A. In 1943 I<sup>13</sup> first reported the use of ultraviolet blood irradiation therapy in 8 cases of pneumonia due to a virus or viruslike organism. I reported the following observations:

1. Complete subsidence of toxic symptoms, twenty-four to seventy-six hours after a single treatment.

\* Read at the Eastern Sectional Meeting of the American Congress of Physical Therapy, Washington, D. C., April 8, 1944.

2. Disappearance of cough in three to seven days.
3. Roentgen ray evidence of a complete clearing of the pulmonary fields twenty-four to ninety-six hours after a single treatment. Since this report was made, these observations have been confirmed by Hancock,<sup>4</sup> Barrett<sup>11</sup> and Anderson.<sup>26</sup>

The relatively rapid disappearance of all subjective and objective signs and symptoms of pneumonia due to a virus or virus-like organism seems significant, as there is as yet no other therapy capable of producing the same results.

B. In mumps the following results may be expected:

1. A drop in temperature to normal within twenty-four to forty-eight hours.
2. A rapid disappearance (in twenty-four to thirty-six hours) of whatever toxic symptoms may be present.
3. A complete subsidence of all swelling of the parotid glands within four to five days. This phenomenon has been observed independently by Knott and Hancock,<sup>5</sup> Moser<sup>23</sup> and myself.<sup>14</sup>

C. In the case of acute poliomyelitis, McFarland and I have already done a certain amount of preliminary work in a recent epidemic. However, owing to the difficulty of evaluating any treatment of this disease, we feel that further work is necessary before a report can be made. It can be said that work to date on this project has been sufficiently encouraging to warrant further investigation.

D. The rapid subsidence of toxic symptoms in virus diseases has been similar to that observed in acute pyogenic infections, so that workers using the Knott technic feel that it exerts a definite and efficient control of all the infections due to a virus or virus-like organism in which it has been used to date.

III. *Increase in the Efficiency of Oxygen Exchange Mechanisms.* — One of the chief events observed by all workers using the Knott technic has been a rapid improvement, or pinkening, of the skin coloration, at first believed to be due entirely to peripheral vasodilation but later believed to be due to peripheral vasodilation combined with an increased ability of the blood to pick up oxygen.

A. In 1939 Miley<sup>1</sup> made a study of the effects of 97 blood irradiation treatments given to persons suffering from various disease processes and observed:

1. Ten minutes later: a 58 per cent increase in venous oxygen.
2. One-half hour later: a 9.2 per cent decrease in venous oxygen.
3. One hour to one month later: a 50 per cent increase in venous oxygen.

No rise in hemoglobin or erythrocyte count occurred which could account for this increase. The majority of the rises in venous oxygen values occurred in persons whose values had been low.

B. In 1942 in a report on 103 consecutive cases of acute pyogenic infection, Miley<sup>16</sup> described a rapid disappearance of cyanosis in an apparently moribund patient suffering from peritonitis, paralytic ileus and bronchial pneumonia. This observation has been confirmed by many other workers.

C. In 1943 Seidel, Christensen and Miley,<sup>18</sup> in a preliminary report on 80 cases of bronchial asthma treated by this method, reported a marked relief of asthmatic symptoms in 80.4 per cent of the cases in which there was an adequate follow-up. Of the patients, 16.1 per cent had been free of symptoms for more than one year, 35.7 per cent had been free for more than six months and in 19.6 per cent there had been no response. In a large number

of these patients the increase in ability to breathe freely and the appearance of a normal pink coloration of the skin were most striking.

Thus it seems probable from laboratory and clinical observations that a definitely favorable effect in increasing the efficiency of oxygen exchange and oxygen metabolism generally can be expected from the use of the Knott technic of ultraviolet blood irradiation.

IV. *Detoxifying Action.* — One of the most easily demonstrable clinical effects of blood irradiation is the subsidence of toxic symptoms within twenty-four to seventy-two hours after treatment. It has been observed consistently in the treatment of acute pyogenic infections and infections due to a virus or virus-like organism. We observed a striking illustration of this action recently<sup>17</sup> in a case of apparently terminal botulism coma, in which the patient was unable to swallow or see at the time of irradiation. Within forty-eight to seventy-two hours the patient, who seemed to be dying from the well known effects of a classic neurotoxin, was able to swallow and to see, was clear mentally and was improved in every way. Thirteen days after a single blood irradiation treatment she left the hospital in excellent condition, and she has remained so ever since. There is to my knowledge no record in medical science of any other therapy that can produce such an effect on a patient in the last stage of botulism.

V. *Profound Effect on the Autonomic Nervous System.* — A. Peripheral vasodilation is readily discernible in approximately three of four persons within the first few minutes after ultraviolet blood irradiation. It may persist for more than thirty days. It is usually accompanied by a feeling of well being and by an increase in venous oxygen. The possibility of increased arterial flow in connection with this phenomenon has been considered but has never been investigated. The appearance of the vasodilation phenomenon can usually be considered a favorable prognostic sign in diseases already reported as amenable to this type of therapy.

B. The rapid abolition of paralytic or adynamic ileus in patients given ultraviolet blood irradiation to control peritonitis was reported by Rebbeck and Miley<sup>19</sup> in 1943. We noted a consistent restoration to normal of smooth muscle tone and contractility of the gastrointestinal tract twelve to twenty-four hours after a single blood irradiation, a phenomenon which was evident clinically by the expulsion of flatus, the appearance of normal intestinal motility and the reappearance of normal abdominal auscultation signs. Such an effect obviously represents a restoration to a normal balance of that part of the autonomic nervous system directly controlling smooth muscle tone and contractility of the abdominal portion of the gastrointestinal tract, a part of the autonomic system apparently hopelessly out of balance before the application of ultraviolet blood irradiation therapy.

C. A similar disappearance of the symptoms of acute thrombophlebitis was reported by Miley<sup>20</sup> in 1943, who observed the following events:

1. Rapid disappearance of pain and tenderness in twenty-four to forty-eight hours following ultraviolet blood irradiation.
2. Return to normal of high temperature in forty-eight to seventy-two hours.
3. Complete subsidence of edema in 12 persons in four to fifteen days. In one patient, marked induration edema was unchanged.

There were no harmful effects.

It was found that there occurred a restoration to normal tone and contractility of the smooth muscle elements of the portion of the peripheral vascular system directly affected by the pathologic changes of acute thrombophlebitis. In turn there was a restoration to normal balance, or function, of the auto-

onomic fibers innervating the smooth muscle of those blood vessels affected by the thrombophlebitis, a portion of the autonomic nervous system which previous to blood irradiation was in an advanced state of imbalance, as shown by the partial or complete breakdown in smooth muscle tone and contractility in the affected area.

D. In the work with bronchial asthma reported by Seidel, Christensen and Miley<sup>18</sup> in 1943, the results observed were most encouraging, especially in view of the fact that in practically all of the cases the disease was considered intractable when blood irradiation was instituted. The relief of bronchial spasm observed in 80 per cent of the cases implies *per se* a return to normal of that part of the autonomic nervous system, apparently hopelessly out of balance, which had been directly affected by the changes involved in the production of bronchial asthma.

### Theoretical Considerations

It does not seem to me at this time that it is too great a step forward to recognize that there exists a definite possibility that disease processes which respond promptly to the intravenous administration of ultraviolet irradiated blood (as carried out by the Knott technic of ultraviolet blood irradiation) have as a powerful contributing type of etiologic agent an actual state of ultraviolet ray deprivation, i. e., an inadequate ultraviolet ray intake and distribution. This hypothesis does not seem particularly incredible as one considers that from time immemorial ultraviolet rays have been an integral part of the environment of all forms of life existing on the earth's surface. It is logical to presume that ultraviolet rays are as much a part of our life as are optimum heat, oxygen supply, adequate diet and general climatic influences.

It is possible, however, that the introduction of irradiated blood intravenously may have a direct stimulative effect over and above the body's actual ultraviolet ray requirements. Such an effect might be called an energizing effect.

It is possible that the relief of an ultraviolet ray deprivation plus an energizing effect may occur to produce the clinical events observed after the intravenous application of ultraviolet irradiated blood.

It is my opinion that the effects on the autonomic nervous system observed after ultraviolet blood irradiation therapy are of a regulatory, or normalizing nature and that their prompt occurrence suggests that the symptoms of the disease state present may be directly due to a breakdown in ultraviolet ray metabolism secondary to an inadequate ultraviolet ray intake.

The expression "ultraviolet ray metabolism" implies a well recognized physiologic phenomenon the mechanism of which is easily demonstrable and clearly understood. Actually the subject is clouded by our ignorance of the subject. Eventually, after much long and painstaking work, we hope to find this cloud brushed away and to obtain a much clearer picture of ultraviolet ray metabolism than is possible in the light of present day knowledge.

In addition to the many known biochemical and physiologic effects of ultraviolet rays, there have been several experimental contributions to our knowledge of ultraviolet ray metabolism worthy of consideration. Outstanding among these have been Finsen's<sup>1</sup> discovery that hemoglobin absorbs all wavelengths of ultraviolet rays; Gurwitsch's<sup>2</sup> demonstration of mitogenetic rays, tiny emanations given off by body tissues in different wavelengths, all in the ultraviolet spectrum and varying in wavelength according to the organ emitting the rays, and the knowledge that ultraviolet ray deprivation can lead to the metabolic disease of rickets and possibly plays



an important role in the increase in diseases of the upper respiratory tract in winter. Furthermore, the physiologic effects observed in several apparently unrelated disease states after the intravenous administration of ultraviolet irradiated blood by means of the Knott technic not only open up a therapeutic field of great potentialities but suggest that an adequate ultraviolet ray intake is of primary importance to the maintenance of normal health. The corollary is that many symptoms of disease states are secondary to a subnormal ultraviolet ray metabolism. In order to clarify this point of view we have presented several of the outstanding physiologic events reported by the various workers using the Knott technic of ultraviolet blood irradiation, notably Hancock,<sup>3-4-5</sup> Rebbeck,<sup>6-7-8</sup> Barrett,<sup>9-10-11</sup> Miley and co-workers<sup>12-20</sup> and, more recently, Barger,<sup>21-22</sup> Moser,<sup>23</sup> Lowry,<sup>24</sup> Anderson,<sup>25-26</sup> VanStone,<sup>27</sup> McFarland<sup>28</sup> and others. It is important that these workers are in general agreement as to the clinical observations made following the use of this therapy.

### Suggested Application in the Case of War Casualties

At present the Knott technic of ultraviolet blood irradiation is not in use by the armed forces. It is my considered opinion that the method, because of its ease of application and lack of harmful effects, would be of great practical value to the medical branches of these forces in the treatment of many acute and chronic illnesses.

Chief among the acute disease processes in which the use of this therapy would prove of great benefit are:

1. Any type of bacterial infection except bacterial endocarditis. From a practical standpoint blood irradiation is definitely indicated in cases of infections produced by bacteria known to be resistant to sulfonamide compounds and penicillin and also in cases in which chemotherapy and the use of penicillin have failed to control the spread of infection.

2. Virus diseases which are known to be resistant to all forms of therapy. These should be treated routinely with ultraviolet blood irradiation, since not only have there been found no contraindications to its use in pneumonia due to a virus or virus-like organism, in mumps, and in poliomyelitis with or without encephalitis, but a rapid and efficient control of the untoward symptoms of these diseases has been noted.

3. Acute thrombophlebitis. This responds to no other therapy so rapidly as it does to the Knott technic of ultraviolet blood irradiation; obviously patients with acute thrombophlebitis, a relatively rare type of complication, should be given this therapy routinely.

In the field of chronic illnesses this method can be recommended highly as a supplementary therapeutic aid in the treatment of the following disease:

1. Intractable bronchial asthma. This condition has been favorably influenced in a relatively high percentage of patients treated by ultraviolet blood irradiation therapy. The relief of the symptoms of this disease in the case of highly specialized personnel who might otherwise become totally incapacitated and discharged from the armed services would be a fertile field of application.

2. Fevers of undetermined origin, chronic fatigue states and low grade chronic infections.

### Summary

The possibility of the existence of a definite ultraviolet ray metabolism in the human body and the probable importance of its recognition are suggested.

The occurrence of five physiologic events observed to occur after the

intravenous administration of irradiated blood by means of the Knott technic are listed, and the probability of their close relationship to ultraviolet ray metabolism is suggested.

### Conclusion

Further studies of the various aspects of ultraviolet ray metabolism and ultraviolet blood irradiation therapy should lead to many interesting findings of both theoretical and practical value.

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# ARCHIVES of PHYSICAL THERAPY

OFFICIAL PUBLICATION AMERICAN CONGRESS OF PHYSICAL THERAPY

## .. EDITORIALS ..

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### GET READY FOR THE CLEVELAND MEETING

Medical meetings are essential for keeping up medical progress and to spread and exchange information about methods both new and old. Physical Medicine plays a particularly important role in the rehabilitation of the injured; the numerous physical therapy departments now caring for the armed forces here and abroad are the proving grounds for much of the reconstructive work that has been developed in recent years by physicians specializing in physical medicine.

It is for these self-evident reasons why the annual meetings of the American Congress of Physical Therapy are continued during the present emergency and why special emphasis is laid on the program of the forthcoming session on rehabilitation. There will be the usual instruction course for physicians and for sponsored technicians. Fellows of the Congress are urged to plan laying all business aside from September 6 to 9 and to attend the meeting at the Hotel Statler in Cleveland.

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### PHYSICAL MEDICINE AND THE LAW

The possibility of medicolegal complications developing from the use of the equipment employed in physical medicine is well known. The internal administration of drugs may sometimes give rise to undesirable results, but the relationship of cause and effect is not nearly so obvious as it is in the use of physical apparatus. Injuries produced in the physical therapy department usually involve the superficial tissues at the point of application of the physical energy and appear during or shortly after the treatment. There is likely to be little or no doubt in the patient's mind as to the cause of the damage when he considers the sequence of events leading up to it. He may, however, be mistaken; the writer has more than once seen the skin lesions of herpes zoster attributed by the patient to some physical procedure applied for relief of the antecedent pain.

Prevention is the best remedy for the medicolegal complications which may occur in physical medicine. In the first place, it should go without saying that the physician who prescribes physical therapy should have an adequate knowledge of the subject. This does not mean that he must specialize, but he should at least familiarize himself with the physiologic effects, the indications and the contraindications of the various procedures which he employs. At the present time, through the efforts of the American Congress of Physical Therapy, the American Medical Association and the recent philanthropy of Mr. Bernard Baruch, opportunities for graduate study in this field are rapidly increasing.

One of the most important factors in the prevention of medicolegal complications in physical medicine is the employment of well trained technicians. The graduates of recognized schools of physical therapy are instructed not only in the correct and careful administration of physical treatment but are

also taught the most rigid adherence to high ethical standards, both of which are equally important in dealing with patients. Unfortunately, although the situation is improving, the supply of these technicians is still inadequate to meet the increasing demand. They are invaluable protection to the physician employing physical therapy.

A third important feature in the prevention of medicolegal difficulty is the meticulous care of, and genuine sympathetic interest in the patient who has received an accidental injury while under treatment. He should never be given the slightest opportunity to feel that he is being neglected. To the average patient this is effective healing balm both physically and psychologically.

In this issue of the ARCHIVES, there appears an important article by Captain H. H. Buckelew on the "Medicolegal Aspects of Physical Medicine." It should be read by every physician who prescribes physical therapy for his patients. Technicians also should read and study this article. It is a valuable contribution to physical medicine.

### ARTIFICIAL RESPIRATION

For the past several decades only two methods of artificial respiration have been considered worthy of discussion in the medical literature, the Silvester method and the Schafer method. The first was described by Silvester in 1858.

Schafer<sup>1</sup> in an experimental comparison of the Silvester procedure with his "prone pressure method" in the passive human subject found the former to yield tidal air of 175 cc. against 520 cc. for the latter. Other advantages claimed for the Schafer method by its originator were that: (1) it was simple and easily learned; (2) it could be performed by a single individual without fatigue; (3) it allowed the tongue to fall forward and facilitated drainage of water and mucous from the respiratory passages. On the basis of these apparent advantages the Schafer method largely replaced the Silvester.

With these few remarks in mind our readers should peruse with added interest the article in this issue of the ARCHIVES by Eve. The author calls attention to a statement made by Surgeon Commander Gibbens that the Schafer method of artificial respiration was rarely successful even though used by trained personnel in the Royal Navy. Eve points out that results obtained in the passive conscious human subject cannot be compared to those in a nearly drowned person. The nearest approach to the latter is the warm cadaver. In experimental tests on the warm cadaver the author obtained tidal air of 30 cc. with the Schafer method and 200 cc. with the Silvester procedure. It is interesting to note that Schafer in his original article stated, "A large number of experiments were performed on the cadaver, which were mostly futile by reason of the difficulties presented by post-mortem rigidity."

Eve recommends a new method of resuscitation by means of alternate raising and lowering of the head and feet on an ordinary cot, supported in the center. This proved to be an efficient means of artificial respiration producing tidal air up to 600 cc. Not only did it produce respiratory effects but circulatory as well. It is reminiscent of the Sanders bed which is employed in the treatment of peripheral vascular disease.

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## MEDICAL NEWS

### Massachusetts Physical Therapy Program

At the annual meeting of the Massachusetts Medical Society held in Boston, May 22, Dr. Kristian G. Hansson read a paper on "Physical Therapy: Its Relation to War Injuries" as part of a symposium on war injuries. At a section devoted to physical therapy, Dr. Wilmot L. Marden and Dr. Howard Moore presided. Captain Sidney Licht, M.C., A.U.S., chief of the department of physical therapy of Lovell General Hospital, Fort Devens, Mass., discussed "Occupational Therapy for War Wounded" and "Physical Medicine in Army Practice."

### Catholic Hospital Association

The second wartime conference and the twenty-ninth annual convention of the Catholic Hospital Association of the United States and Canada was held in St. Louis May 21 to 26. At a sectional meeting with the theme "The Hospital's Place in Physical Restoration," the presiding officer was Dr. Jack Masur, Surgeon (R) USPHS, assistant chief medical officer, Office of Vocational Rehabilitation, Federal Security Administration, Washington, D. C. Dr. John S. Coulter, of Chicago, spoke on "The Adequacy of the Physical Therapy Service;" Ella V. Fay, of Cook County Hospital, Chicago, on "The Development of an Occupational Therapy Department," and Irene E. Morris, Ph.D., director of the department of medical social service, St. Mary's Group of Hospitals, St. Louis, on "Medical, Social and Vocational Rehabilitation."

### National Foundation for Infantile Paralysis

A greatly enlarged program of preparations to combat epidemics of infantile paralysis that may occur this year has been launched by The National Foundation for Infantile Paralysis in co-operation with state and local health authorities in various parts of the nation, it was disclosed by Basil O'Connor, President of The National Foundation.

Mr. O'Connor's statement was issued from the Hotel Waldorf-Astoria at the semi-annual meeting of medical advisors of The National Foundation got under way there for two-day session. The National Foundation's 38 medical advisers, men eminent in such fields as virology, orthopedics, pediatrics, epidemiology, physiology, neurology and public health not only consider applications for new grants and appropriations for advancing the Foundation's scientific research program but also advise The National Foundation in its preparations to meet epidemics and to care for the patients who are stricken.

"No one can predict what will happen in 1944, but we must be prepared for any eventuality,

both as a national health measure and as a wartime necessity," said Mr. O'Connor.

"The precautionary steps taken last year by The National Foundation and health authorities were of great benefit when this nation suffered its third worst epidemic of poliomyelitis, with 12,404 cases reported. One of the outgrowths of the 1943 outbreak was the expansion of The National Foundation's program for 1944, especially for training personnel in the Kenny method of treatment.

"Infantile paralysis is unpredictable. No one can forecast the future with any degree of accuracy. But there is one thing we do know—there most likely will be epidemic outbreaks of the disease somewhere in the United States in 1944."

These preparations include placing of respirators at strategic locations throughout the nation, ascertaining hospital facilities for acute and convalescent care; determining how many doctors, nurses and technicians are available; surveying such transportation facilities as ambulances and other vehicles and the personnel available to man them; ascertaining diagnostic and laboratory facilities; and also the preparation of material and equipment, including wool for use in the modern hot pack treatment.

As a result of The National Foundation's program for training personnel in the Kenny method of treatment, there are now many hundreds of doctors, nurses and physical therapy technicians prepared to administer that treatment, and thousands of others are familiar with it, Mr. O'Connor pointed out.

He said that conferences already have been held between Foundation officials and health authorities in various parts of the country and that such meetings will be continued. Polio usually starts its upward swing in June and reaches its peak in September.

### Capt. Walter M. Simpson Commended

Capt. Walter Malcolm Simpson, formerly of Dayton, Ohio, and now on duty at the U. S. Naval Hospital, Long Beach, Calif., received a letter of commendation "for meritorious performance of duty while serving as chief of medicine and later as executive officer of the first advanced naval base hospital to be established in the South Pacific Area during the period from April 12, 1942 to Nov. 1, 1943. Captain Simpson reflected great credit on himself by his outstanding professional ability, leadership and keen judgment. As liaison officer he dealt with officials of foreign nations with tact and diplomacy, thus contributing materially to the harmonious relations with foreign nationals. As president of the Malaria



Control Commission and Sanitary Commission he organized and initiated the measures which led to the control of tropical diseases. His courageous conduct was in keeping with the highest traditions of the United States Naval Service." Dr. Simpson graduated from the University of Michigan Medical School, Ann Arbor, in 1924 and entered the service Jan. 3, 1941.

#### **New Professorship in Medical Literature**

Dr. Frederick R. Taylor, associate professor of clinical medicine, Bowman Gray School of Medicine of Wake Forest College, Winston-Salem, has been named to a newly created position of professor of medical literature. The course in medical literature and medical writing includes instruction of the students in the relative value of various publications, the ethics of medical writing and the editing of medical papers. The course also instructs the students in the ways of keeping abreast of medical literature and stresses its importance to the physician.

#### **New Medical Journal**

The *Northern New York Medical Annual* made its appearance in April. The publication, which will be issued once a year, contains news and scientific material about physicians of northern New York. Dr. Howard N. Cooper is chairman of the board of editors, other members of which include Drs. Charles A. Prudhon, Sutherland E. R. Simpson, William W. Hall, George F. J. Bock and Garner Scullard, all of Watertown. The publication is sponsored by the Jefferson County Medical Society, which hopes to use it as a medium for members in the armed forces.

#### **Convalescent Care**

Dr. A. L. Van Horn, chairman of the committee on convalescent care of the National Society for Crippled Children, announces the employment of Miss Kathleen Allen, a medical social worker, to direct a study on convalescent care in the United States for the committee. The personnel of Dr. Van Horn's committee is: Dr. A. F. Voshell, Professor of Orthopedic Surgery, University of Maryland; Dr. Waldo E. Nelson, Professor of Pediatrics, Temple University; Miss Edith M. Baker, Chief Medical Social Consultant, U. S. Children's Bureau; Dr. Elise H. Martens, Sr. Specialist in Education of Exceptional Children, U. S. Office of Education; Mrs. Jewell Gaffney, R.N., Executive Secretary, Crippled Children Society of the District of Columbia, and Harry H. Howett, Director of Research, National Society for Crippled Children.

#### **Ultraviolet Air Sterilization**

At the forty-fifth annual meeting of the American Therapeutic Society, being held in Chicago, June 10, Dr. Reginald A. Higgins, Port Chester, N. Y., will speak on "Effect of Ultraviolet Air Sterilization on Incidence of Respiratory Infections in a Children's Institution."

#### **Colonel Thorndike to Speak on Reconditioning**

When the American Association for the Surgery of Trauma holds its fifth annual convention in Chicago, June 9 and 10, Col. Augustus Thorndike, Jr., M.C., will speak on "The United States Army's Reconditioning of the War Wounded."

#### **Physical Therapy for the Deafened**

Willis C. Beaslet, Ph.D., addressed the American Otological Society at their recent seventy-seventh annual meeting on the subject of "The Future of Physical Therapy for the Deafened."

#### **Dr. Pearson Named Editor of State Journal**

Dr. Homer L. Pearson, Jr., Miami, was appointed editor of the *Journal* of the Florida Medical Association at the annual meeting of the state medical association in St. Petersburg, April 14. He succeeds Dr. Shaler A. Richardson.

#### **Dr. Fishbein Honored**

Dr. Morris Fishbein, Editor of *The Journal of the American Medical Association*, has been elected a member of the Chicago chapter of Sigma Delta Chi, national professional journalistic fraternity.

#### **Committee on Convalescence and Rehabilitation of the National Research Council**

*Chairman:* Dr. William S. Tillet, Department of Medicine, College of Medicine, 477 First Avenue, New York; Dr. Winfred Overholser, St. Elizabeth's Hospital, Washington, D. C.; Dr. George W. MacKenzie, Mary Imogene Bassett Hospital, Cooperstown, N. Y.; Dr. Joseph T. Wearn, Western Reserve University, Cleveland, Ohio; Dr. Robert W. Johnson, 4 E. Madison Street, Baltimore, Md.; Dr. Robert Elman, 600 S. Kingshighway Blvd., St. Louis, Mo., and Dr. Harold T. Wolff, New York Hospital, 525 E. 68th St., New York.

#### **Knudsen Award Goes to Dr. Vonachen**

On May 11 the Knudsen Award of the American Association of Industrial Physicians and Surgeons was presented to Dr. Harold A. Vonachen, medical director of the Caterpillar Tractor Company, Peoria, Ill., for initiating and developing a plan to fit disabled workers to jobs and jobs to disabled workers, started in his own plant two years ago and developed through close cooperation with the medical personnel and safety division and the training and manufacturing department. When the success of the plan at Caterpillar was assured, it was carried forward to the community, where seventeen community organizations are represented on the executive committee of what has now become the Peoria plan for human rehabilitation of civilians and military.

### Joint Orthopedic Nursing Advisory Service of National League of Nursing Education — Proposal for Combined Program of Study in Orthopedic Nursing and Physical Therapy

This program is planned to offer a more adequate training program for the preparation of qualified orthopedic nurses and physical therapy technicians for civilian and military services. The plan is set up to prepare personnel for the following services:

1. Supervisory positions in orthopedic nursing in hospitals.

2. Staff or supervisory positions in orthopedic services in public health nursing agencies. (Local agencies, and from one-fourth to one-third of the state agencies, providing orthopedic services offer a combined service of orthopedic nursing and physical therapy under the direction of the orthopedic supervisor or consultant qualified in both public health nursing and physical therapy.)

3. Staff or supervisory positions in physical therapy.

#### Organization and Administration

This program of study should be established in an accredited university and on a level that credit can be granted for all work taken. This would be facilitated if the program were offered in a university where an approved program of study in physical therapy, an approved program of study in public health nursing and advanced courses in nursing education are already established. If these programs are not set up in the same university it is suggested that cooperative arrangements be made between universities offering these programs in the same locality. Adequate facilities for clinical practice should be readily accessible in hospitals and public health nursing agencies.

It is recommended that the combined program of orthopedic nursing and physical therapy be offered in units which are an integral part of the total plan and should be taken in proper sequence.

#### Advantages of the Plan

1. It offers a more comprehensive program of study than is now available, particularly for public health nurses who must qualify in both orthopedic nursing and physical therapy.

2. It is flexible in that it meets the needs of different groups of students. Students may enroll for the orthopedic nursing or physical therapy units independently, or may take the combined program.

3. It is economical in the use of equipment, clinical practice fields, teaching personnel, time and money of students.

- a. Library, laboratory and clinical practice facilities could be used by all students.

- b. Courses common to each program such as anatomy, orthopedic conditions, etc., could be taught to all students by the same instructor.

- c. Nurses enrolled in the orthopedic nursing unit would not lose credit or duplicate work if they decided to complete requirements in physical therapy later.

- d. It is believed that three months time might be saved for those taking the combined program.

Six months would be required for the unit in orthopedic nursing and nine months for physical therapy. Because of subjects common to each unit it is estimated that the combined program could be completed in twelve months.

### Content of Theory and Clinical Practice, Qualifications of Teaching Personnel, Correlation of Program

It is recommended that the Council on Medical Education and Hospitals of the American Medical Association and the Joint Orthopedic Nursing Advisory Service of the NOPHN and the NLNE give consultant service to universities which desire to set up such a program.

#### Accreditation

It is understood that the Council on Medical Education and Hospitals would be responsible for approval of the physical therapy unit of such a combined program and that a national nursing agency would be responsible for accrediting the nursing unit.

### Dr. Winford H. Smith Is Chairman of Medical Supplies Committee

The combined Production and Resources Board recently announced the appointment of Dr. Winford H. Smith as American member and chairman of its Medical Supplies Committee. Dr. Smith has been director of Johns Hopkins Hospital, Baltimore, for more than thirty years.

#### Misbranded Products

Abstracts of Notices of Judgment issued by the Food and Drug Administration of Federal Security Agency.

[Editorial Note. — These Notices of Judgment are issued under the Food, Drug and Cosmetic Act in cases in which they refer to drugs and devices they are designated D. D. N. J. and foods, F. N. J. The abstracts that follow are given in the briefest possible form: (1) the name of the product; (2) the name of the manufacturer, shipper or consigner; (3) the date of shipment; (4) the composition; (5) the type of nostrum; (6) the reason for the charge of misbranding, and (7) the date of issuance of the Notice of Judgment—which is considerably later than the date of the seizure of the product and somewhat later than the conclusion of the case by the Food and Drug Administration.]

*Tu-Way Massagers.* — E. W. Arnold Company, Logansport, Ind. Shipped Aug. 21, 1941. A massaging device which "consisted of a series of rubber-covered disks, attached to a handle, which were to be rolled over portions of the body." Misbranded because of false and misleading representations in accompanying circular that it was founded on an exact scientific principle and would positively remove the fat spots, beautify the figure and break down fatty deposits so that they would be oxidized within the body, with the result that the residue would be carried away by the blood stream and disappear through the organs of elimination, leaving the flesh firmer and more solid; that it would be wonderfully soothing and strengthening to tired, aching

neck and shoulders; that it would be effective in correcting fleshy, corpulent and pendulous abdomens, and stimulate activity of the liver. — [D. D. N. J., F. D. C. 692; February, 1943.] Rep. J. A. M. A. 124:946 (March 25) 1944

### Courses of Instruction in the Modern Principles and Treatment of Poliomyelitis

The National Foundation urges its Chapters to assist well qualified persons in their localities, through scholarships for tuition, travel, living stipends, etc., to secure training in the care of the infantile paralysis patient.

Courses of instruction in the modern principles and treatment of infantile paralysis, including the Kenny method, are being offered at the schools and universities listed below:

Stanford University, School of Health (Women)  
Stanford University, California

Miss Catherine Worthingham, Director,  
Division of Physical Therapy

Courses for: Physicians; Physical Therapy Technicians.

Length of Courses: Physicians, three days; Technicians, five weeks.

Admission Requirements:

Physicians—Doctor of medicine in good standing.

Technicians—Senior member of American Registry of Physical Therapy Technicians; member of American Physiotherapy Association; graduate of approved school of physical therapy.

Tuition: Physicians, none; Technicians, \$42.00 (\$39.00 if student has previously attended Stanford University).

Credit: Technicians, four units of university credit. Letter certifying completion of course, if requested.

Childrens Hospital Society

Los Angeles, California

Miss Lily H. Graham, Technical Director,  
School of Physical Therapy

Course for: Physical Therapy Technicians.

Length of Course: Nine weeks.

Admission Requirements:

Graduate of approved school of physical therapy; member of American Registry of Physical Therapy Technicians; member of American Physiotherapy Association; physical therapist sent from Class A hospitals and clinics.

Tuition: \$15.00.

Credit: Certificate.

University of Minnesota

Minneapolis, Minnesota

Dr. William O'Brien, Director,  
Postgraduate Medical Education

Courses for: Physicians; Physical Therapy Technicians; Nurses.

Length of Courses: Physicians, five and a half days; Technicians, twelve weeks; Nurses, eighteen weeks.

Admission Requirements:

Physicians—Doctor of medicine in good standing.

Technicians—Member of American Registry of Physical Therapy Technicians; member of American Physiotherapy Association; graduate of approved school of physical therapy.

Nurses—Registered nurse.

Tuition: Physicians, \$25.00; Technicians, \$39.00; Nurses, \$56.50.

Credit: Certificate.

The Georgia Warm Springs Foundation Graduate  
School of Physical Therapy  
Warm Springs, Georgia

Dr. Robert L. Bennett, Director

Courses for: Physicians; Physical Therapy Technicians; Nurses.

Length of Courses: Physicians, one week; Technicians, four to eight weeks; Nurses six to nine months. Two to three weeks (nursing aspects and hot packs only).

Admission Requirements:

Physicians—Doctor of medicine in good standing.

Technicians—Member of American Registry of Physical Therapy Technicians; member of American Physiotherapy Association; graduate of approved school of physical therapy.

Nurses—Registered nurse.

Tuition. None.

Credit: Letter certifying completion of course.

New York University School of Education  
New York City

Dr. George Deaver, Curriculum Director,  
(Sponsored by The Greater New York Chapter of  
the National Foundation)

Courses for: Physical Therapy Technicians and  
Qualified Nurses.

Length of Courses: Eight weeks.

Admission Requirements:

Member of the American Registry of Physical Therapy Technicians or of the American Physiotherapy Association; graduate nurse with orthopedic experience recommended by a National Foundation Chapter. Applicants who do not meet these admission requirements but have the educational qualifications and experience may present their credentials for consideration.

Tuition: \$75.00.

Credit: Six units of university credit. Certificate.

University of Pennsylvania Graduate School  
of Medicine  
Philadelphia, Pennsylvania

Dr. George Morris Piersol, Director of Course,  
(Sponsored by the Philadelphia County Chapter of  
the National Foundation)

Course for: Physical Therapy Technicians.

Length of Course: Eight weeks.

Admission Requirements:

Member of American Physiotherapy Association or American Registry of Physical Therapy Technicians; graduate of approved school of physical therapy.

Tuition: \$150.00 (125.00 for students sent by Chapters of the National Foundation).

Credit: Certificate issued by the University of Pennsylvania.

D. T. Watson School of Physiotherapy  
Leetsdale, Pennsylvania

Dr. Jessie Wright, Director,

Courses for: Physicians; Physical Therapy Technicians; Nurses.

Length of Courses: Physicians, minimum of one

week; Technicians, minimum of four weeks; Nurses, minimum of two weeks.

#### Admission Requirements:

Physicians—Doctor of medicine in good standing.

Technicians—Member of American Registry of Physical Therapy Technicians; member of American Physiotherapy Association; graduate of approved school of physical therapy.

Nurses—Registration.

The short courses for nurses (two or three weeks) offered at the D. T. Watson School of Physiotherapy and the Georgia Warm Springs Foundation are designed to instruct the nurse only in the purely nursing aspects of the acute stage of infantile paralysis and in the application of hot packs. They do not prepare the nurse to do muscle re-education or take over any physical therapy treatment.

The courses for physicians at the University of Minnesota, the Georgia Warm Springs Foundation, Stanford University, and the D. T. Watson School of Physiotherapy are designed to acquaint the physician with the Kenny method of treatment and the modern concepts of infantile paralysis, so that he may supervise the treatment.

The courses for physical therapy technicians, and the long courses for nurses, are designed to instruct the student in the complete care of the infantile paralysis patient, including the Kenny method of treatment.

Dates of scheduled courses, present living accommodations, and information in addition to that given may be secured directly from the teaching centers.

### Occupational Therapy Consultant Appointed

Miss Borghild Hansen joined the staff of the National Tuberculosis Association, April 1, to serve as occupational therapy consultant and field secretary in rehabilitation. She was formerly chief occupational therapist at the Montefiore Hospital Country Sanatorium, Bedford Hills, and before that was at the Westchester Division of the New York Hospital, White Plains, N. Y. Her academic training in occupational therapy was at the University of Minnesota, where she received a B.S. degree.

The Rehabilitation Department of the National Tuberculosis Association has been expanding rapidly in recent months. This new position is to provide a channel of information for therapists and recruit mature personnel for tuberculosis work.

### Advisory Committee on Services for Crippled Children

Just released by the U. S. Department of Labor is the following list of those appointed by the Secretary of Labor, May, 1943, for a 3-year term:

Chairman, Oscar L. Miller, M.D., Medical Arts Building, 121 West 7th Street, Charlotte, N. C. Consulting Orthopedic Surgeon, North Carolina Orthopedic Hospital.

Kathleen Allen, Elizabethtown, Pa. Medical Social Consultant, State Hospital for Crippled Children, Pennsylvania Department of Health.

Carl E. Badgley, M.D., 1313 East Ann Street, Ann Arbor, Mich. Professor of Surgery, Division Orthopedic Surgery, University of Michigan Medical School.

Bernzdetta Banker, R.N., Mt. Clemens, Mich. Superintendent, Cummings Hospital School.

Lucy E. Blair, R.N., Madison, Wis. Physical Therapy Consultant, Bureau of Handicapped Children, Wisconsin Department of Public Instruction.

James Barrett Brown, Lt. Col. U. S. Army Medical Corps, Phoenixville, Pa. Chief, Plastic Surgery, Valley Forge General Hospital. Associate Professor of Clinical Surgery, Washington University School of Medicine, St. Louis, Mo. (On leave.)

Zdenka Buben, 808 North Spring Street, Los Angeles, Calif. Director, Bureau of Medical Social Service, Los Angeles County Health Department.

Robin C. Buerki, M.D., 36th and Spruce Streets, Philadelphia Pa. Dean, Graduate School of Medicine, Medico-Chirurgical College, University of Pennsylvania.

John W. Chenault, M.D., Tuskegee Institute, Ala. Director of Orthopedic Surgery, Infantile Paralysis Center, Tuskegee Institute.

Edward L. Compere, M.D., 116 South Michigan Boulevard, Chicago, Ill. Associate Professor of Surgery, Northwestern University Medical School.

John S. Coulter, M.D., 122 South Michigan Avenue, Chicago, Ill. Professor and Chairman, Department of Physical Therapy, Northwestern University Medical School.

Ruth Council, R.N., Raleigh, N. C. Orthopedic Nursing Consultant, Crippled Children's Department, Division of Preventive Medicine, North Carolina Board of Health.

Ruth Emerson, Chicago, Ill. Director, Social Service Department, University Clinics, University of Chicago.

Mrs. Gertrude R. Folendorf, R.N., 19th and 20th Avenues, Lawton and Morgan Streets, San Francisco, Calif. Administrator, Shriners' Hospitals for Crippled Children.

Louise F. Galvin, M.D., Richmond, Va. Director, Rheumatic Fever Program, Crippled Children's Bureau, Virginia Department of Health.

Stanley Gibson, M.D., 104 South Michigan Avenue, Chicago, Ill. Chairman, Department of Pediatrics, Northwestern University Medical School.

Arthur Bruce Gill, M.D., 1930 Chestnut Street, Philadelphia, Pa. Emeritus Professor of Orthopedic Surgery, University of Pennsylvania School of Medicine. President, American Orthopedic Association.

Clifford G. Grulee, M.D., 636 Church Street, Evanston, Ill. Secretary and Treasurer, American Academy of Pediatrics. Editor, American Journal of Diseases of Children. Rush Professor of Pediatrics, University of Illinois.

Wilton L. Halverson, M.D., 760 Market Street, San Francisco 2, Calif. Director, California Department of Public Health.



Marie L. Hines, 2065 Adelbert Road, Cleveland, Ohio. Director of Dietetics, University Hospitals of Cleveland.

T. Duckett Jones, M.D., 25 Binney Street, Boston, Mass. Research Director, House of the Good Samaritan.

Lawrence J. Linck, 201 West Monroe Street, Springfield, Ill. Director, Division of Services for Crippled Children, University of Illinois.

Francis E. Lord, Ypsilanti, Mich. Director, Horace H. Rackham School of Special Education.

Mary Macdonald, R.N., 137 Newbury Street, Boston, Mass. Orthopedic Supervisor, Visiting Nurse Association of Boston.

Hugh McCulloch, M.D., 325 North Euclid Avenue, St. Louis, Mo. Associate Professor of Clinical Pediatrics, Washington University School of Medicine. Editor, *The Journal of Pediatrics*.

Robert B. Osgood, M.D., 372 Marlborough Street, Boston, Mass. Professor Emeritus of Orthopedic Surgery, Harvard University Medical School.

Winthrop M. Phelps, M.D., 3038 St. Paul Street, Baltimore 18, Md. Director, Children's Rehabilitation Institute, Cockeysville, Md.

W. W. Plummer, M.D., 89 Bryant Street, Buffalo, N. Y. Professor of Orthopedic Surgery, University of Buffalo School of Medicine.

Ruth Raattama, M.D., Boise, Idaho. Director, Maternal and Child Health and Crippled Children's Service, Idaho State Department of Public Health.

Edward S. Rogers, M.D., Albany, N. Y. Assistant Commissioner, Office of Medical Administration, New York Department of Health.

Alfred R. Shands, Jr., Major, U. S. Army Medical Corps, A. A. F. School of Applied Tactics, Station Hospital, Orlando, Fla. Consultant in Orthopedic Surgery, Army Air Forces. Medical Director, Nemours Foundation, Wilmington, Del. (On leave.)

Marion W. Sheahan, R.N., Albany, N. Y. Director, Division of Public Health Nursing, New York Department of Health.

Jessie L. Stevenson, R.N., 1790 Broadway, New York 19, N. Y. Consultant on Orthopedic Nursing, Joint Orthopedic Nursing Advisory Service.

Mrs. Zephyr Holman Stewart, 426 East 51st Street, Chicago 15, Ill. Director of Social Service, Provident Hospital and Training School.

R. C. Thompson, 1112 Lexington Building, Baltimore, Md. Supervisor, Vocational Rehabilitation, Maryland Department of Education.

## Hard of Hearing Council

Dr. Boris V. Morkovin, supervisor of the hearing division of the psychologic clinic of the University of Southern California, has just been made president of the Southern California Council of the American Societies for the Hard of Hearing. This council which has eighteen chapters, has an extensive program for directing the rehabilitation of persons whose hearing has been affected by the modern mechanisms of warfare.

In the current issue of the *Hearing Survey Quarterly*, of which Dr. Morkovin is co-editor, he describes the most dangerous handicap of the hard of hearing as being psychologic, not physical. "The uncertainty of the future, the growing sense of isolation often lead into serious neurosis," he says.

## Rehabilitation Exhibit

A group of exhibits emphasizing the current importance of rehabilitation and reemployment of the disabled was presented at the annual session of the American Medical Association by the Council on Industrial Health and the Council on Physical Therapy of the American Medical Association in cooperation with representatives of the Army, Navy, Veterans Administration and Federal Security Agency. The committee in charge consisted of Carl M. Peterson, Council on Industrial Health; Howard A. Carter, Council on Physical Therapy; C. F. Behrens, Captain (MC), U.S.N., Naval Medical Center, Bethesda, Md.; Donald L. Rose, Major, M.C., A.U.S., Walter Reed Hospital, Washington, D. C.; K. A. Carroll, Hines Hospital, Hines, Ill.; Dean Clark, Office of Vocational Rehabilitation, Federal Security Agency, Washington, D. C.

The following subjects were included and demonstrated by: 1. Fractures: Kellogg Speed, Chicago; 2. Amputations: Henry H. Kessler, Captain (MC), U.S.N.R.; 3. Lamé Backs: Frank R. Ober, Boston; 4. Hard of Hearing: William E. Grove, Milwaukee; 5. Tuberculosis: Leroy U. Gardner, Saranac Lake, N. Y.; 6. Heart Disease: William D. Stroud, Philadelphia; 7. Psychiatry: George S. Stevenson, New York; 8. Community Relations: Harold A. Vonachen, Peoria, Ill., and Reemployment: Max R. Burnell, Flint, Mich.

Walter J. Zeiter was in charge of the Physical Therapy demonstrations of the lame back exhibit. He was assisted by the following physicians: Frank H. Ewerhardt, St. Louis; Miland E. Knapp, Minneapolis; Frank H. Krusen, Rochester, Minn.; C. O. Molander, Chicago; Madge C. L. McGuinness, New York; Milton G. Schmitt, Chicago and Max Newman of Detroit.





## BOOK REVIEWS

A MANUAL OF PHYSICAL THERAPY. By *Richard Kovács*, M.D., Professor of Physical Therapy, New York Polyclinic Medical School and Hospital. Third edition. Pp. 309, 118 illustrations. Cloth. Price, \$3.25. Philadelphia: Lea & Febiger, 1944.

This third edition represents a revision of the author's text "Physical Therapy for Nurses." In spite of the change in title there is no radical change in content or style of presentation. The chapters on electrotherapy, heat and light have been reorganized. Some new illustrations appear and techniques of the more common regional applications have been amplified. A short section on hypothermia has been added. The description of massage technic has been improved by eight new photographs. The chapter on exercise written in collaboration with Dr. Madge C. L. McGuinness has been largely rewritten and contains more specific information on body mechanics and corrective exercises including a brief description of the Kenny method of treatment of infantile paralysis. A noteworthy addition is a chapter on the application of Physical Medicine in the treatment of war casualties. As a text for use in elementary training courses for physical therapy technicians this manual serves a very useful purpose. It is not designed for the physician specializing in the field of Physical Medicine but should prove valuable to other physicians wishing to know the essentials of physical therapy.

AN OUTLINE OF GENERAL PHYSIOLOGY. By *L. V. Heilbrunn*, Professor of Zoology in the University of Pennsylvania. Second Edition. Revised. Cloth. Pp. 748, with 135 illustrations. Price, \$6.00. Philadelphia: W. B. Saunders Co., 1943.

Physiology is too extensive a subject to be covered in a single volume. It is for this reason that teachers of physiology find it difficult to use any one single text for their students. This book was written in order to meet the needs of Dr. Heilbrunn's students. As the author points out the book is essentially an outline of general physiology. While the discussions are brief, the author has directed attention to an excellently selected group of references so that the teacher or student may profitably study any subject of interest quite extensively. Dr. Heilbrunn has attempted to give some authority for each statement he has made.

The author prefers to consider general physiology in the broadest possible sense; as the science which deals with all forms of living material, to discover the nature and mechanism of living matter. The early chapters deal with a brief survey of the morphology of living cells, followed by a discussion of their chemical makeup. There follows a consideration of the physical properties of living

systems and a treatment of the kinetics of living matter.

Information is presented about such new topics as the vitamin needs of lower organisms, the relation of vitamins to oxidative processes, and the utilization of the electron microscope. The chapter headings of the first edition have not been changed but the contents chapters have been extensively revised.

This is certainly an excellent text book and the author has accomplished the ideal he set for himself. No physiologic library would be complete without this splendid book. Physical therapists should find it to be of particular value in the chapters on the production of electricity, bioluminescence and muscular contraction.

THE BUSINESS OF GETTING WELL. By *Marshall Sprague*. Illustrated by Ervine Metzl. Cloth. Pp. 143. Price, \$1.75. New York: Thomas Y. Crowell Company, 1943.

This book was written for laymen by a layman. It is an amusing narration of the author's physical and emotional experience on being confined to bed in a hospital for a long period. Although written in a light vein, the book is the sincere effort on the part of the author to convey to other patients the philosophy and attitudes that sustained him during his long illness.

He relates his initial adjustment to living in bed and his preoccupation with such narrow confines. Following this, he describes the arrangement of his room so that he was able to carry out with a minimum of effort his interests and hobbies which became so important during the many months. There are humorous chapters on hospital gossip, mutual interest of patients and the joys of teasing the "probie" nurses. In one chapter called "Are doctors human?" the author decides that they are and asks, "Why, in a Y. M. C. A. shower stripped of pince-nez, stethoscope, black bag, and faint odor of lozenges, do they look exactly like you or me, even in their manner of hobbling about on their heels to avoid athlete's foot?"

He lays down laws for visiting persons who are ill, he compares the advantages of hospital and home care and especially stresses the importance of carrying out the physician's orders to the last letter. He mentions this latter point many times throughout the book and seeks to impress readers with the wisdom of following orders.

The few illustrations in the book are appropriate and clever. All in all, the author, a former newspaperman, has succeeded in writing a witty yet serious book on "The business of getting well."

This book can be recommended to anyone. It can be recommended to recalcitrant patients by physicians. It would be of interest to those who enjoy reading that is light and interesting. It would be of especial value to invalids who are in need of a boost. Physicians, after reading this book, might say: "Would that all my patients were as charming!"

**A STUDY OF ABSENTEEISM AMONG WOMEN.** By S. Wyatt, D.Sc.; R. Marriott, B.Sc.; D. E. R. Hughes. Paper. Price, 2d net. Pp. 12, with 8 illustrative tables of data. London, England: His majesty's stationery Office, 1943.

This is a report following a limited, 6-weeks study of absenteeism among the women of the Royal Ordnance Factories. It does not deal with the cause of absenteeism but primarily with the amount and distribution. The results show that 84.5 to 70.5 per cent of the women were absent for some part of this time. Married women lost more time than single women. The longer periods of absences were mainly due to sickness and were more numerous among married women. Sixty per cent of the total number of absences were from single shifts; most of these occurred during the morning shift. Absenteeism for women increased from Sunday to Wednesday, followed by a decrease specifically on pay day at the end of the week. Absenteeism was highest in the lower age groups—under twenty-five. These conclusions are based on findings obtained in only two factories and were considered not necessarily representative of conditions in England's industry as a whole.

**HEALTH EDUCATION ON THE INDUSTRIAL FRONT.** The 1942 Health Education Conference of the New York Academy of Medicine. Cloth. Price, \$1.25. Pp. 63. New York: Columbia University Press, 1943.

This small book consists of a collection of papers carrying out a timely discussion of the basic changes of industrial medicine and the newly created problems by a select New York group. The broad and unusual health aspects arising out of the wartime industrial condition of the community are first presented as a basis for the following subjects. These enter into food and nutrition; disease and handicap detection and control; mental problems and educational methods, taking advantage of human motives for accident control.

A fine and significant evaluation of the present trend in the field of public health is concisely presented in the contribution by Dr. Leonard Greenburg. The discussion of mental problems and morale in industry by Dr. Lydia Giberson is particularly apropos in view of the soon-to-be expected influx of such cases and the lag of practical understanding and planning for their successful industrial rehabilitation. This informative, small book represents an excellent effort toward the appreciation of the war-created medical prob-

lems which are of particular concern due to their inevitable continuance and enhancement through the remainder of the war into the post-war peace.

**CLINICAL EVALUATION OF THE REHABILITATION OF THE TUBERCULOUS.** EXPERIENCE AT ALTRO WORK SHOPS, 1915-1939. By Louis E. Siltzbach, M.D., Chest Physician, Committee for the Care of the Jewish Tuberculous, Inc., Associate Attending Physician, Division of Pulmonary Diseases, Montefiore Hospital. Cloth. Pp. 70, 4 engravings. Price, \$1.00. New York: National Tuberculosis Association, 1944.

This is an interesting and timely report on the successful rehabilitation of the tuberculous patient discharged from sanatorium treatment, by the employment of the sheltered city workshop. It was started in 1913 as an experiment by the Committee for the Care of the Jewish Tuberculous, Inc., so as to bridge for city dwellers the wide gap between the sanatorium and the home. Patients of the Altro Workshops were started on limited physical activity under careful medical supervision in the model plant with a maximum of fresh air and sunshine and all forms of sanitary control. This booklet presents the 25 year cumulative experience of these workshops and outlines methods which have proved successful in the restoration to gainful employment of a high percentage of tuberculosis victims. It presents many useful specific data for the information and guidance of personnel officers, industrial physicians and workers in the field of rehabilitation. Thirty-three tables and a number of graphs add to the completeness and vividness of the presentation and prove that post sanatorium relapses can be reduced. "Particularly following the careful selection of the last decade, many such patients have demonstrated their ability to maintain their clinical status for many years after leaving the sanatorium. A number have become completely self-supporting at the workshop." Two factors make this report more than ever timely. Acute lack of manpower for war production emphasized by government directives, makes us conscious of the potential production capacity of the handicapped. Just ahead of us too is the reabsorption and adjustment of those war workers, whether in uniform or in civilian industry, with old tuberculous lesions which may flare into progressive disease under the changes and stresses of these times. Both of these are important national problems. "Fortunately, industry is becoming more tolerant, less fearful of a history of arrested tuberculosis (even in the face of Workmen's Compensation liabilities). Medical workers in public and voluntary agencies who are equipped with a knowledge of tuberculosis must help employers to distinguish between those who have active disease, and therefore should not be employed, and the large and growing number of efficient and desirable persons with arrested disease who should have a chance to contribute to the war effort. The immediate employment opportunities are unique."

Copies of this extremely valuable study are be-

ing distributed through state and local tuberculous associations, cloth bound for \$1 each and in paper cover at 50 cents.

**FUNDAMENTALS OF PSYCHIATRY.** By *Edward A. Strecker, M.D., Sc.D., F.A.C.P.* Professor of Psychiatry and Chairman of the Department, Undergraduate School of Medicine, University of Pennsylvania; Psychiatrist to the Pennsylvania Hospital; Attending Psychiatrist, Psychopathic Division, Philadelphia General Hospital; Consultant to the Bureau of Medicine and Surgery, United States Navy; Consultant to the Secretary of War, A. A. F. Second Edition. Cloth. Pp. 219, 15 Illustrations. Price, \$3.00. Philadelphia, London, Montreal: J. B. Lippincott Company, 1944.

This is an authoritative and up-to-date presentation of the subject of psychiatry coming at a time when psychiatry has more to offer than ever before in its history. The author pays much attention to the modern conception of psychosomatic medicine and feels that a closer union between internal medicine and psychiatry will produce valuable results. The book has grown out of the teaching experience of the author. It presents all the aspects of the subject in a clear-cut fashion beginning with the importance and opportunities of psychiatry, etiology and classification of mental diseases, methods of examination and symptoms, leading on to the discussion of the three great groups of mental conditions: organic psychoses, toxic psychoses, and functional psychoses and psychoneuroses, followed by a chapter on different reaction types. Most valuable and timely are the two final chapters on the psychiatry of the war and war neuroses. There are 15 diagrammatic illustrations and a number of tables, all of which have been subjected to the test of the classroom—perhaps the severest test any book may receive. Under present day conditions all medical men must needs acquire a minimum of psychiatric information and skill, and Strecker's volume which offers the essential data on modern psychiatry in a systematic and usable fashion should be highly welcomed.

**THE NATURE AND TREATMENT OF MENTAL DISORDERS.** By *Dom Thomas Verrier Moore, O.S.B., Ph.D., M.D.*, Professor of Psychology and Psychiatry, Catholic University of America. Foreword by *Edward A. Strecker, M.D.*, Professor of Psychiatry, Graduate and Undergraduate Schools of Medicine, University of Pennsylvania; Consultant and Chief of Service, Institute of the Pennsylvania Hospital, Philadelphia. Price, \$4.00. Cloth. Pp. 312. New York: Grune & Stratton, 1944.

This scholarly treatise on clinical psychiatry endeavors to present the conception and treatment of mental disorders on the basis of a sound psychology and psychopathology. It is divided into four parts with 16 chapters: Part I, Psychopathology: The Concept of Mental Disorder, Type Concepts of Psychopathology, Some Fundamental Principles of Psychopathology, The Origin and Course of Some Common Phobias; Part II, Therapy by Psychological Analysis: Free Association and Dream Analysis, Interpretation of Life History by Free Association; Part III, Miscellaneous Techniques: Mental Disorders Secondary to Organic Conditions, General Reorganization of the Patient's Life, Mental Difficulties Arising from Problems of Married Life, Family Problems and Their Treatment, Mental Therapy by Family Reorganization, Educational Therapy, Bibliotherapy, Hysterical Manifestations in Children; Part IV, Organic Emotional Disorders: The Physiology of the Emotions, Pharmacological Treatment of Mental Disorders. An appendix contains the classifications and definition of the clinical entities of psychiatry. The author has attempted to outline, criticize and supplement the classic theories of psychopathology and to make use of these theories in order to throw light on the nature of mental disorders. One of the advantages of the volume is that it leads back to psychiatric understanding from the description of highly interesting and pertinent case reports. Much of the research work which has made possible this study was aided by a grant of the Rockefeller Foundation. Dr. Moore's book should prove helpful to the psychiatric physician irrespective of his particular psychiatric beliefs, as well as to physicians, medical students, psychiatric nurses and to social workers.



## PHYSICAL THERAPY ABSTRACTS

### **Tender Muscles in Sciatica. Electromyographic Studies. Frank A. Elliott.**

Lancet 1:49 (Jan. 8) 1944.

The purpose of the article is to record some observations on the tender spots, sometimes described as nodules, found in the muscles of the buttock and calf in certain cases of sciatica. They commonly occur in muscles with an extensor function, are sharply localized, and, when palpated, give rise to pain which may radiate down the limb. Both the local tenderness and the sciatica itself can in some cases be abolished by injecting procaine into the tender spots, whereas the injection of a similar amount elsewhere is without effect because the action is local. It is not surprising therefore that contemporary writers have fostered the belief that these tender spots are the site of an inflammatory or rheumatic process which gives rise to referred sciatic pain and that the successful exhibition of procaine confirms the diagnosis and by inference excludes other causes. It is not generally recognized that tender spots indistinguishable from the more benign forms of myalgia both in their clinical features and in their responses to procaine may be found in the muscles supplied by an irritated nerve-root. This is most commonly met with in sciatica due to prolapse of the nucleus pulposus, but also occurs in spinal tumors.

There is a form of myalgia, arising in muscles supplied by an irritated root, which simulates so-called fibrositis both clinically and in its response to local injections of procaine and is responsible for a variable and sometimes considerable proportion of the patient's total discomfort. Relief from procaine does not, therefore, exclude a root lesion. Electromyographic studies show that the tender spots in muscles are as a rule the seat of a localized increase of irritability and a continuous discharge of action potentials which lasts as long as the needle remains in the muscle. On clinical grounds it is inferred that this activity is not merely the sustained response of irritable muscle to the presence of the myogram needle, but represents involuntary spasm of small groups of muscle fibers. Certain characteristics of the motor discharge appear to support this view, but further work is necessary to confirm it. The spasm is thought to be the source of pain and tenderness. Similar activity has been recorded in "fibrositis" of the shoulder girdle and in the extensor muscles of the arm and forearm in cases of "brachial neuritis" both with and without root signs. Muscle spasm is consequently considered to play a part in what may for convenience be called the rheumatic myalgias as well as in the less common root syndromes. On theoretical grounds any source of irritation, whether in the

root or not, could serve to generate reflex spasm, but in practice there appear to be additional unknown factors which determine the presence of spasm in some cases and not in others.

### **Physiologic Nonsense and Poliomyelitis.**

J. A. M. A. 124:236 (Jan. 22) 1944.

Since the demonstration of the value of the treatment of poliomyelitis described by Miss Kenny, studies have been made in an attempt to explain the physiologic and pathologic conditions associated with the observed effects. The adherents of the Kenny theory have asserted that the harm of infantile paralysis is due to "spasm" of the affected muscles rather than to a flaccid paralysis. Qualified investigators have shown that this is not the case. As stated recently by Cobb, it is being demonstrated once more in the history of medicine that new and empirical methods of treatment backed by uncritical enthusiasm may produce many cures but much physiologic nonsense. The treatment may be good, but the *ex post facto* conclusions of the therapist are usually bad.

### **Neuromuscular Electrodiagnosis. Sidney Licht.**

Bull. U. S. Army M. Dept. 72:80 (Jan.) 1944.

Electrodiagnosis has not received the attention its importance warrants, in this country. During peacetime the number of peripheral nerve lesions is small and the clinician has sufficient time to evaluate damage and progress by tedious muscle function tests. The number of nerve injuries resulting from combat casualties is so great that rapid methods of diagnosis are desirable. Electrodiagnosis is rapid, exact and independent of patient cooperation. This article offers no new information, but catalogues briefly those tests which are of great value in military medicine and which to the author's knowledge are not available under one cover in the English language.

There are several diseases in which muscle-nerve testing is a great aid in differential diagnosis. Inasmuch as the group is heterogeneous they are listed alphabetically.

Bell's palsy, hysterical paralysis, myasthenia gravis, myotonia congenita, poliomyelitis, polynuronitis.

Wilson's disease is characterized by hemianesthesia and pupillary reaction to pain. If faradic stimulation of the extremity muscles of such a patient shows a myodystonic contraction (R. M. D.) the diagnosis of Wilson's disease is most likely. The myodystonic reaction consists of slow disconnected contractions during and after faradic stimulation.



**Tenosynovitis—an Industrial Disability.** Jewett V. Reed, and Allan K. Harcourt.  
Am. J. Surg. 57:394 (Dec.) 1943.

With the speeding up of production in most types of work, it is obvious that it is the duty of the industrial surgeon to do everything possible to reduce disability in injured workmen. In order to test the efficiency of some of our methods of treatment, we are analyzing various groups of cases in order to determine whether or not our methods can be improved.

The treatment of acute tenosynovitis has been to put the part to rest by means of a plaster splint. This is removed about every second day in order to give the parts gentle passive motion to prevent stiffness, and also for the application of a diathermy treatment. After the acute symptoms have subsided, the patient is allowed to use the part for very slight movements only. When all pain has subsided the patient is allowed to resume his work gradually. Permitting patients to return to work too soon has been the cause of recurrence in several cases. When a distinct nodule is found, it is excised and the sheath repaired. When there is a fusiform swelling of the tendon with a constriction of the sheath, the latter should be "windowed" to allow free motion of its contained enlarged tendon.

**Cerebellar Syndrome Following Heat Stroke.** Walter Freeman, and Edith Dumoff.

Arch. Neurol. & Psychiat. 51:67 (Jan.) 1944.

The lethal effects of high body temperatures are well known; nevertheless, over brief periods the temperature may rise as high as 111 F., or even higher, with rapid and complete recovery. The period must be brief because at such high temperatures the pathologic alterations in the body cells rapidly become irreversible. The cells of the central nervous system are particularly susceptible to any prolonged noxious influence, such as anoxia, trauma, alcohol and bromide intoxication; hence it is not surprising to find fever itself induces rapid and severe alterations. In their paper the authors point out that certain cells in the central nervous system are more liable to specific pathologic changes in that borderland of heat stroke between total death and total recovery. Numerous cases of so-called neurotic sequels to heat stroke have been reported, but few in which the pathologic process was so strikingly indicated by clinical symptoms pointing to cerebellar dysfunction as in the case which is reported.

**Nature of Natural Therapeutic Agents Used at Health Resorts.** Walter S. McClellan.

J. A. M. A. 124:426 (Feb. 12) 1944.

There are five general ways of administering mineral waters. In the first place they may be taken in the form of baths in which temperature, time and nature of constituents play a part. Secondly, the mineral waters may be used for the preparation of hot packs when the factor of heat

is of primary importance. Thirdly, they may be utilized for gargles and also for colonic or vaginal irrigations. Again, mineral water properly nebulized by mechanical means may be inhaled, in which treatment it reaches all parts of the respiratory tree. Its influence here, of course, may be local on the irritated membranes, or it may be general from the absorption of minerals or gases which are present in finely divided form in the vapors. Finally, and probably the most widespread method of application, is the internal use, whereby patients take varying amounts of mineral waters during a regular program of treatment at the resort or may follow their more regular use at home when the mineral waters are bottled for general distribution.

An advantage of the mud treatments over electric treatments is that large surfaces, several joints, can be treated at one time, the pliable mud evenly surrounding whole limbs; an advantage over hot water baths is the higher point of indifference, which enables the patient to endure temperature above 50 C. in the mud without paradoxical vasomotor reactions. The patient and his family can be taught to apply the heated mud at home and so reinforce the efficiency of the usual office treatments in the aforementioned chronic disorders.

**Standardization of Non-Ionizing Radiations.**

Brit. M. J. 4337:262 (Feb. 19) 1944.

The Medical Research Council has appointed the following as a committee to advise and assist it in promoting the quantitative study of the non-ionizing radiations, particularly in relation to their medical applications: Prof. H. Hartridge, M.D., F.R.S. (chairman); F. Bauwens, M.R.C.S.; R. B. Bourdillon, D.M.; E. Rock Carling, F.R.C.S.; Prof. J. A. Carroll, Ph.D.; J. Guild, F. Inst. P. (nominated by the Department of Scientific and Industrial Research); Prof. F. L. Hopwood, D.Sc., and Prof. W. V. Mayneord, D.Sc. (secretary). In 1928 and 1937 satisfactory units for the measurement of ionizing radiations were agreed internationally, and there is urgent need of a corresponding standardization for the non-ionizing radiations. Under this heading will be included infra-red, visible and short-wave wireless radiations, but it may be found advisable to deal also with ultraviolet and ultrasonic radiations, since none of these was covered by the earlier recommendations.

**Deep Massage.**

Correspondence, Brit. M. J. 4337:268 (Feb. 19) 1944.

Sir:—In these days of emphasis on rehabilitation by progressive exercises surgeons may lose sight of the fact that certain soft-tissue lesions, commonly met with at fracture and orthopaedic clinics, cannot be cured or at best slowly, by active movements alone. Masseuses should be urged to display their therapeutic powers and thus bring into prominence the essential nature of the services they can give in this part of their



field. Surgeons in charge of these clinics are thus asked to cooperate by sending to their masseuse, with a request for deep friction to the site of the lesion, cases of non-specific tenosynovitis at the wrist and ankle; supraspinatus and patellar tendinitis; traumatic and rheumatic lesions of any part of the erector spinae muscle, of the deep lumbar fascia and of the supraspinous ligaments; injury, whether recent or long-standing, to the internal lateral or coronary ligaments at the knee.

It is not generally realized quite how effective deep massage can be in mobilizing soft structures so placed that active movements alone achieve this end imperfectly or not at all. This fact leads me to request that masseuses should be given a chance to show how indispensable their manual work can be in the proper case. Though the conditions listed constitute only a small fraction of a masseuse's scope, they have been selected for their slow recovery under orthodox treatment and for the spectacular response that adequate friction regularly achieves.

**Nerve Fiber Counts and Muscle Tension After Nerve Regeneration in the Rat. Paul Weiss, and C. J. Campbell.**

*Am. J. Physiol.* 140:626 (Feb. 1) 1944.

The ability of regenerating axons to branch is common knowledge. However, not all of the branches thus produced are destined to make functional connections or even to survive, and superabundant nerve sprouting does not imply correspondingly abundant peripheral innervation.

In an attempt to determine whether the volume of fiber regeneration after nerve transection is indicative of the degree of recovery of power in the reinnervated muscles, nerve fiber counts of regenerated sciatic nerves were compared with measurements of isometric tension produced by the gastrocnemium muscle after "direct" and "indirect" stimulation with "maximal" shocks. The following conclusions have been reached:

There is no constant relation between the number of fibers growing from the proximal stump of the nerve and the number found in the peripheral stump. Spontaneous regulatory axon branching to compensate for fiber deficits does not occur. Profuse branching may, however, be evoked by scar tissue at the suture line. Yet, even this does not of itself insure that the volume of nerve fibers reaching the muscles will be correspondingly amplified.

From 9 to 69 per cent of the muscle fibers of the reinnervated muscles have failed to receive functional reinnervation. These deficits can be correlated with fiber deficits in the peripheral nerve trunk only grossly. In the individual case, the discrepancy may be great. For instance, a quota of only 62 per cent regenerated fibers in the nerve may reinnervate as many as 80 per cent of the muscle fibers (D18), while, conversely, nerve regeneration of as much as 76 per cent may provide only 55 per cent reinnervation (D10).

Factors affecting the density and functional effectiveness of regenerative muscle reinnervation are 1, number of fibers in the proximal nerve

stump; 2, axon branching in the scar; 3, fiber admission into the peripheral stump; 4, secondary resorption of fiber branches; 5, proportion of fibers effecting myoneural junctions; 6, extent of intramuscular axon branching; 7, condition of the muscle fibers. This variety explains why regenerative success is not solely predicated on the intensity of fiber proliferation at the suture line.

**Chartered Society of Physiotherapy.**

*Lancet* 1:200 (Feb. 5) 1944.

The King in council has approved a proposal by the Chartered Society of Massage and Medical Gymnastics to change its name to the Chartered Society of Physiotherapy. The society, founded 40 years ago, now has nearly 14,000 members. In a letter to the *Times* of January 24 Sir Herbert Eason points out that a chartered physiotherapist today is trained not only in massage and gymnastics but also in electrical and all forms of ray therapy.

**Body Mechanics and Industry. W. N. Leak.**

*Brit. J. Phys. Med. & Indust. Hyg.* 6:176 (Nov.-Dec.) 1943.

It is perhaps well to state at the outset that this article is intended not to be authoritative but suggestive; in other words its aim is rather to stimulate interest than to answer questions, more to suggest a new line of approach to our problems than to propagate definite conclusions. It is indeed an attempt to show the bearing that some of the commonplaces of physical medicine may have on our industrial experience, and even although it is largely stressing the obvious it is often the obvious that most easily escapes attention.

The author's interest in this subject was aroused when he first realized what a large number of the children he examined who suffered from varying degrees of scoliosis. It was rare to examine a child of from fourteen to sixteen years of age who held himself or herself with both shoulders at exactly the same level.

**Royal Society of Medicine, Section of Physical Medicine, Double Beam Cathode-Ray Oscilloscope. G. E. Donovan.**

*Brit. J. Phys. Med. & Indust. Hyg.* 6:187 (Nov.-Dec.) 1943.

The cathode-ray tube is becoming increasingly used as a recording device in the fields of medicine and biology.

Although the single beam oscillograph suffices for most medical problems, a still greater field of usefulness is opened up if there are two beams in the one tube. The double beam cathode-ray oscillograph removes the one remaining excuse for the moving mirror type of oscillograph which is retained by some workers for ease in examining two traces simultaneously. The electronic switch is an alternative method of showing two patterns on one screen simultaneously, but it is more complicated and more expensive than the

double beam system. Owing to the fact that the double beam cathode-ray has two spots capable of independent deflection in the vertical direction, whilst being deflected simultaneously in the horizontal direction by a common time base, it permits the direct visual simultaneous observation of two phenomena such as a phonocardiogram and an electrocardiogram. On the other hand, the disadvantages of the double beam tube are comparatively slight. The brightness of each beam is less than the brightness of an undivided beam, also it is impossible to employ push-pull deflection to the Y plates. When the same signal is applied to both Y plates, the beams are deflected in opposite directions and not in the same direction. The apparent phase reversal can be easily compensated for by an extra stage of amplification for the deflection of one of the Y beams.

**Refrigeration Anesthesia in Surgery. Victor Richards.**

Ann. Surg. 119:199 (Feb.) 1944.

Allen, in 1941, was the first to demonstrate clinically that a tourniquet could be applied to a limb and that the part distal to the tourniquet could be enveloped in ice to produce after a suitable period of time surgical anesthesia. Not only was anesthesia complete but subsequent operation could be achieved in a bloodless and practically shockless field. This method of refrigeration anesthesia, it soon became apparent, was particularly suitable for leg amputations in extremely poor-risk patients suffering from diabetes or arteriosclerosis. All authors have implied, however, that many aspects and uses of this method are disputations and have encouraged further reports of clinical experiences with its proposed applications.

From an analysis of the available clinical and experimental material many of the advocated advantages of refrigeration in infection, shock, traumatic injuries, vascular occlusions and reconstructive extremity surgery seem untenable. It was hoped that refrigeration might enable the preservation of the vitality of limbs suffering from these afflictions which would ordinarily have to be sacrificed. Bacterial growth is retarded by refrigeration but so, also, is the tissue response to inflammation, and on release of the cooling the inflammatory reaction may even be aggravated.

In an injured extremity with an intact blood supply the application of a tourniquet is extremely hazardous, for it increases immeasurably the subsequent shock by adding to trauma the effects of tissue asphyxia. It is highly questionable if cooling alone of such a limb is of value. If a tourniquet must be applied to an injured extremity, then refrigeration of the anoxic parts distal to the tourniquet will lessen greatly the subsequent shock on release of the tourniquet. Care must still be preserved, for although gross necrosis and postmortem changes in the asphyxiated tissues will not occur the highly specialized nerve and muscular tissues in the limb may be irreparably damaged by ischemic fibrosis. The same objection to refrigeration anesthesia may be voiced

against its use in extensive reconstructive operations on an extremity where a prolonged bloodless and shockless field would be desirable. Similar objections obtain in using refrigeration in the presence of vascular occlusion of an extremity. If embolectomy fails to restore the integrity of the limb, cold would have a constrictive effect on the existing collateral circulation and would probably retard the development of new collateral channels. Without a tourniquet a limb could probably not be cooled sufficiently to prevent recurrent intravascular clotting in the damaged vessel following embolectomy.

The application of a tourniquet combined with refrigeration will eliminate the absorption of toxins, promote bacteriostasis, avoid gross necrotic changes in the limb and permit removal of the limb in a bloodless, shockless and completely anesthetic field. Herein, lies the main advantage of refrigeration anesthesia. Lower amputations are permissible, necrosis of the stump is lessened, amputation may be undertaken through a potentially infected field, and subsequent drainage of infection in and healing of the stump controlled by post-operative cooling. The dangers of spreading thrombosis or embolism are obviated. Pneumonia postoperatively, must be cautiously avoided.

**Thalassotherapy. Charles I. Singer, and Kenneth Phillips.**

J. A. M. A. 124:1128 (April 15) 1944.

These authors state that thalassotherapy is the utilization of ocean climate in preventing and treating disease. Its main factors—sun, air and water—act by their influence on the skin and the mucous membranes as receptor organs. The blood and the autonomic nervous system are used as conductors of their effects; thereby acclimatization is achieved, with the endocrine system acting as a possible "pacemaker."

The rationale of thalassotherapy includes (a) a sojourn at the seashore (a stay of six to eight weeks) partial or complete (institutional) supervision. There are indications and contraindications for climatic stimulation and for climatic sedation.

Thalassotherapy is of military as well as public health importance.

**Careful Hospital Program Outlined for Disabled Soldiers, Sailors.**

Hosp. Management 56:23 (Nov.) 1943.

The readjustment and happiness of wounded soldiers and sailors with conspicuous physical disfigurements or disabilities or nervous manifestations will depend in large measure on the way their families and friends and the public at large behave toward them. This has been stated by the Office of War Information in a release which also summarized the rehabilitation and employment facilities provided for servicemen disabled in combat.

It is only natural that maimed young men should think bitter thoughts, lose their self-con-

fidence. It is the exceptional man who does not not.

And yet, in case after case, maimed young men have been freed from their black thoughts and bitterness, and have had their self-confidence restored, by the professional, expert, and difficult, rehabilitation treatment they have received, as soon as possible after injury, in Army and Navy hospitals and in the hospitals of the Veterans Administration. Disabled merchant seamen are cared for in U. S. Public Health Service Marine Hospitals.

In all these institutions, the restoration of self-confidence, as an aid in the restoration of physical health, is the immediate aim of doctors, nurses and other personnel.

#### **Shockless Surgery With Refrigeration Anesthesia.**

Leonard C. Hallendorf, and Edwin B. Winnett.

J. Iowa M. Soc. 34:15 (Jan.) 1944.

Only a few years ago many surgeons would hesitate to operate on elderly, poor-risk patients with gangrene of the extremities, because of the high mortality rate involved in this type of surgery. Although radical surgery was the only hope for cure, the mortality rate was often as high as eighty per cent. The thought of having an operation was so demoralizing to the patient of advanced age that this in itself constituted a major factor in the production of a poor prognosis. No longer will the debilitated, diabetic patient with gangrene need to dread an operation which may take his life because of shock, infection, pneumonia, or other postoperative complications. No longer will the surgeon be reluctant to operate on these patients because of the former, inevitably poor results.

The authors have presented five cases of amputation with refrigeration anesthesia and for the most part they were successful. One death occurred, which was caused by cerebral thrombosis that was probably coincidental and not related to the surgery. They have demonstrated that surgery with refrigeration anesthesia is an effective method in treating gangrene of the extremities in certain elderly, emaciated, poor-risk patients.

#### **The Treatment of Sulfonamide Resistant Gonorrhea: Preliminary Report.** Earl C. Lowry, and Linus W. Hewit.

Mil. Surg. 93:453 (Dec.) 1943.

The investigations reported were made with a view of making some observations on the minimum temperature level and the length of time necessary for the cure of sulfonamide resistant gonorrhea by heat therapy and sulfathiazole combined.

Fifty (50) consecutive cases of sulfonamide resistant gonorrhea were treated with fever therapy at 105 F. for five hours, after having received seven Gms. of sulfathiazole during the eighteen hour period prior to treatment. Eighty-two per cent of the cases so treated were cured by the first treatment and eighteen per cent were failures. Fever therapy in combination with sulfa-

diazine at a temperature of 105 F. for five hours has proved satisfactory in a small series of cases. It is believed any factor which produces urethral stasis and uncleanliness, contributed toward chronicity in these cases. Hence phimosis, the small meatus, and urethral strictures were dealt with prior to the administration of fever therapy.

General supportive measures such as high caloric bland diet, forcing fluids to 4,000 cc. daily, hot sitz baths, and absolute cleanliness of the genitalia, are important factors in curing these cases. The period of hospitalization can be markedly reduced by the use of fever therapy at 105 F. for five hours, in combination with sulfathiazole in cases of sulfonamide resistant gonorrhea; however no final conclusions are to be drawn from such a small series of cases, especially where dispersion of cases, following discharge from the hospital, prohibits adequate follow-up. The fact that no case was returned to this hospital does not mean that admissions did not take place, unknown to us, in other hospitals. It is the plan of the authors to present complete data following completion of five hundred (500) cases.

#### **Prevention of Hemorrhages in the Brain in Experimental Electric Shock.** Gert Heilbrunn.

Arch. Neurol. & Psychiat. 50:455 (Oct.) 1943.

The occurrence of hemorrhages in the central nervous system of experimental animals following electrically induced convulsions gained additional practical significance from the reports by Levy and Alpers and Hughes of similar hemorrhages in the human brain. A search for appropriate preventive measures to forestall the appearance of such lesions therefore appeared obligatory.

Preparatory injections of atropine sulfate, synthetic vitamin K, calcium gluconate, a thromboplastic suspension of brain substance and various combinations of the last three preparations prior to electrically induced convulsions failed to prevent hemorrhages in the brains of experimental rats. Since no hemorrhages were seen in animals in which convulsions had been completely prevented by ether narcosis, it was concluded that the changes in pressure accompanying the convulsion, and not the current itself, represent the causative factor in the formation of such lesions.

#### **Combined Convulsive Therapy and Psychotherapy of the Neuroses.** John D. Moriarty, and Andre A. Weil.

Arch. Neurol. & Psychiat. 50:690 (Dec.) 1943.

In psychiatry the factor of time has been a difficult obstacle to surmount. In the past few years insulin, metrazol and, finally, electric shock therapy have shortened the period of hospitalization of patients with the major psychoses. Unfortunately, the problem of the neurotic patient, who requires much individual effort and consideration, has received relatively little attention in this respect. Only a few studies of the application of shock treatment to the neuroses have been made.



Twenty neurotic patients in the New Hampshire State Hospital who received a combination of convulsive treatment and active psychotherapy have been studied. This study was undertaken primarily to evolve a practical procedure of treatment rather than to make a statistical comparison of different types of treatment. The usual procedure of choice is first analytic psychotherapy, followed by four to six electric shock treatments and, finally, by efforts at reeducation. In 50 per cent of the series the disease was considered to be in remission; in 45 per cent the condition was much improved or improved and in 5 per cent it was questionably improved. The period of hospitalization for treatment of the neuroses is definitely shortened. Follow-up studies indicated a satisfactory adjustment and gain in inner resources in the vast majority of our patients. All were able to leave the hospital. The conception of the healing mechanism is presented by the authors to be as follows: Shock therapy prepares the ground for psychotherapy by improving the affective tone, fostering active co-operation and tending to overcome the "repetition compulsion." Psychotherapy permits the patient to gain understanding and inner fortitude, as a guard against relapse.

#### Section of Orthopaedics. Discussion on Painful Feet.

Proc. Roy. Soc. Med. 36:57 (Dec.) 1942.

Mr. C. Lambrinudi: The foot problem in the Army is a fairly formidable one. In my experience alone, working at several clinics, I find that a third of the cases sent up by the regimental officers for an expert orthopaedic opinion are foot cases.

Most orthopaedic surgeons in charge of busy clinics, if asked before the war who suffered most from foot trouble, men or women, would unhesitatingly have answered—women, in at least a proportion of 5 to 1. Because so many of us had become accustomed to associate foot pains and deformities with women, the erroneous conclusion was drawn that they were due to some female peculiarity or to their particular form of footwear. But experience of war has shown that foot troubles are as common in men, under stress, as in women. This was not realized in peacetime because men did not then use their feet to the same extent, or under the same trying conditions. A man was better able to select his occupation according to his capacity. He could rest at weekends, and, on the whole, did not go to a doctor unless his disability interfered with his wage-earning capacity. But a woman was constantly on her feet tending her home and children; she did not rest at weekends, and she was periodically subjected to the stresses of pregnancy. Moreover, women were employed in larger numbers in such trying occupations as shop assistants and waitresses and because of restricted choice they were obliged to wear shoes unsuitable for overworked feet.

It is evident that the foot problem on the whole

is muscular fatigue, leading to ligamentous strain and foot-wear only came into the picture in so far as it was an extra stress.

More than half of the total of service out-patient attendances at an E. M. S. Hospital are for disabilities of the foot. Fifty-seven per cent of painful feet are associated with deformity of the anterior or longitudinal arches or with callosities. The majority have suffered minor foot disability prior to Army life. Long hours of marching or arduous training, rather than drill, or trades, is the precipitating cause of foot breakdown. Remedial treatment has, in our hands, been largely disappointing. This is, in part, due to lack of the incentive to get better; in part to the advanced type of case which is admitted to hospitals. Operative treatment is seldom indicated in the treatment of the service foot, hammer toes, occasional tenotomies and removal of exostoses, being the only operations performed. In civilians, better results can always be obtained.

#### The Electrocardiogram and the "Two-Step" Exercise. A Test of Cardiac Function and Coronary Insufficiency. A. M. Master; S. Nuzie; R. C. Brown, and R. C. Parker.

Am. J. M. Sc. 207:449 (April) 1944.

An experience gained over many years has proven the practical value of the "electrocardiogram following the two-step exercise" in 3 ways: First, the blood pressure and pulse response indicate circulatory fitness by a standardized measurement of vasomotor response. Second, the ECG changes are an indication of the oxygen supply of the heart muscle itself. Third, the control ECG reveals the presence of arrhythmias and is an indication of the condition of the myocardium with the patient at rest.

The test is of importance in differentiating functional from organic heart disease, particularly when physical examination, Roentgen ray film, fluoroscopy and ECG are negative.

Positive changes in the ECG after the "two-step" exercise indicate anoxemia of the heart muscle or coronary insufficiency. Both this test and the 10 per cent oxygen anoxemia test were performed on every person considered in this report. The ECG changes correspond almost exactly in both tests.

The exercise must be standardized for age and weight since changes occur in normal people if the effort is excessive. Tables giving the number of trips to be performed by normals have been published. In normal persons the blood pressure and pulse return to within 10 points of resting levels in 1½ minutes. The following changes in the "electrocardiogram after the two-step" are considered abnormal: A depression of the RST segment of more than 0.5 mm. in any lead, a change from an upright T wave to an isoelectric (flat) or inverted T wave or T-wave changes in the opposite direction.

In patients with coronary heart disease the test is of particular value in detecting coronary insufficiency when it is latent.

In valvular heart disease the test discloses the state of cardiac function and whether the cardiac output is adequate for the coronary arteries.

In patients with hypertension the control ECG often shows evidence of coronary insufficiency and therefore may not change after exercise. There is a lag in return of the blood pressure and pulse following the "two-step" exercise in effort syndrome (neurocirculatory asthenia) and the ECG gives evidence of anoxemia of the heart muscle following exercise. In this syndrome we believe there is a congenitally small, hypoplastic heart which is inadequate on effort.

In chest deformities and in congenital heart disease the "electrocardiogram after the two-step" is valuable.

An upper respiratory infection, lung disease, gastroenteritis, fatigue and lack of sleep may produce abnormal results.

The "electrocardiogram after the two-step" is a short, harmless and practical test. It is suggested that it should be a routine procedure in men over 40 in the military service and also for eliminating the unfit for special services where unusual physical and mental strain are experienced.

#### Daylight and Dust.

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It has been known since Kirstein's extensive experiments in 1902 that certain pathogenic bacteria, particularly members of the respiratory group (for example, tubercle and diphtheria bacilli, streptococcus, and pneumococcus), may, after natural drying, remain alive for many days or weeks. However, Flugge's earlier work showing the limited range of infective droplets expelled by consumptive patients during coughing and talking, together with the difficulty experienced in infecting guinea pigs with dried tuberculous sputum, led to a general acceptance of the dictum that the spread of respiratory infections occurred predominantly by the spray or droplet method, which requires close contact between infective and susceptible persons.

The bactericidal action of the ultraviolet rays from sunlight or from special lamps is well known, and has lately been used in American hospitals and schools to control the spread of respiratory infections, and in surgical theatres to prevent skin sepsis after prolonged operations. Direct daylight, apart from sunlight, is also known to be bactericidal, but daylight diffusing through ordinary glass has usually been regarded as inert because of the removal of the ultraviolet rays. Some of the ultraviolet light does in fact penetrate ordinary glass, and American work has shown that this diffused daylight is bactericidal.

Ultraviolet light, though powerfully bactericidal against moist bacteria, is much less active against dried bacteria, and is largely inactivated by the presence of gross particles of dust. In spite of this Garrod has found that the dust in first floor wards which were receiving a fair amount of daylight yielded a much lower proportion of streptococcus positive samples than the dust of ground floor wards whose windows were bricked up. Similarly, 42 samples of dust on black-out screens adjacent to the windows failed to yield any hemolytic streptococci, whereas 56 per cent of the floor dust samples were positive. This is only circumstantial evidence of the bactericidal activity of daylight through glass, and no doubt other factors were operative, for example, ventilation and variations in the source, composition and degree of pollution of the dust. More direct proof of the bactericidal activity of daylight was afforded when films of naturally dried streptococcal pus placed in glass covered Petri dishes and exposed to daylight through glass were sterilized in six to nineteen days, a south light being rather more active than a north light. Control films in a dark cupboard yielded viable streptococci up to 110 days.

#### March Foot (March Fracture). Its Early Diagnosis and Treatment.

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The subject of march fractures has been recently brought to the fore because of the rigorous training a soldier must undergo in preparation for modern warfare. Breithaupt, a Prussian, first wrote of this condition in 1855, followed by several late articles by men in this country, France and England. Analyzing a large number of so-called march fractures it is believed that the term march foot more nearly describes the condition and that the fracture is only a part of the syndrome. The sequence of occurrence and the three types of lesions and their description, leading to this conclusion, are described.

The four important points for early diagnosis of march foot are described: Typical history, dorsal swelling and possible ecchymosis, palpable mass or callus, point tenderness at fracture or callus site. Roentgenograms may or may not show fracture or callus early. March foot is classified into three distinct categories. With symptoms as just outlined treatment is started immediately and continued until pain has disappeared. An ambulatory-type of strapping is presented. Certain severe fractures are hospitalized and treated by strapping or cast. Convalescence requires three to six weeks and is definitely shortened by strapping and semi-ambulatory method.

"March foot" is perhaps a better term for this syndrome.